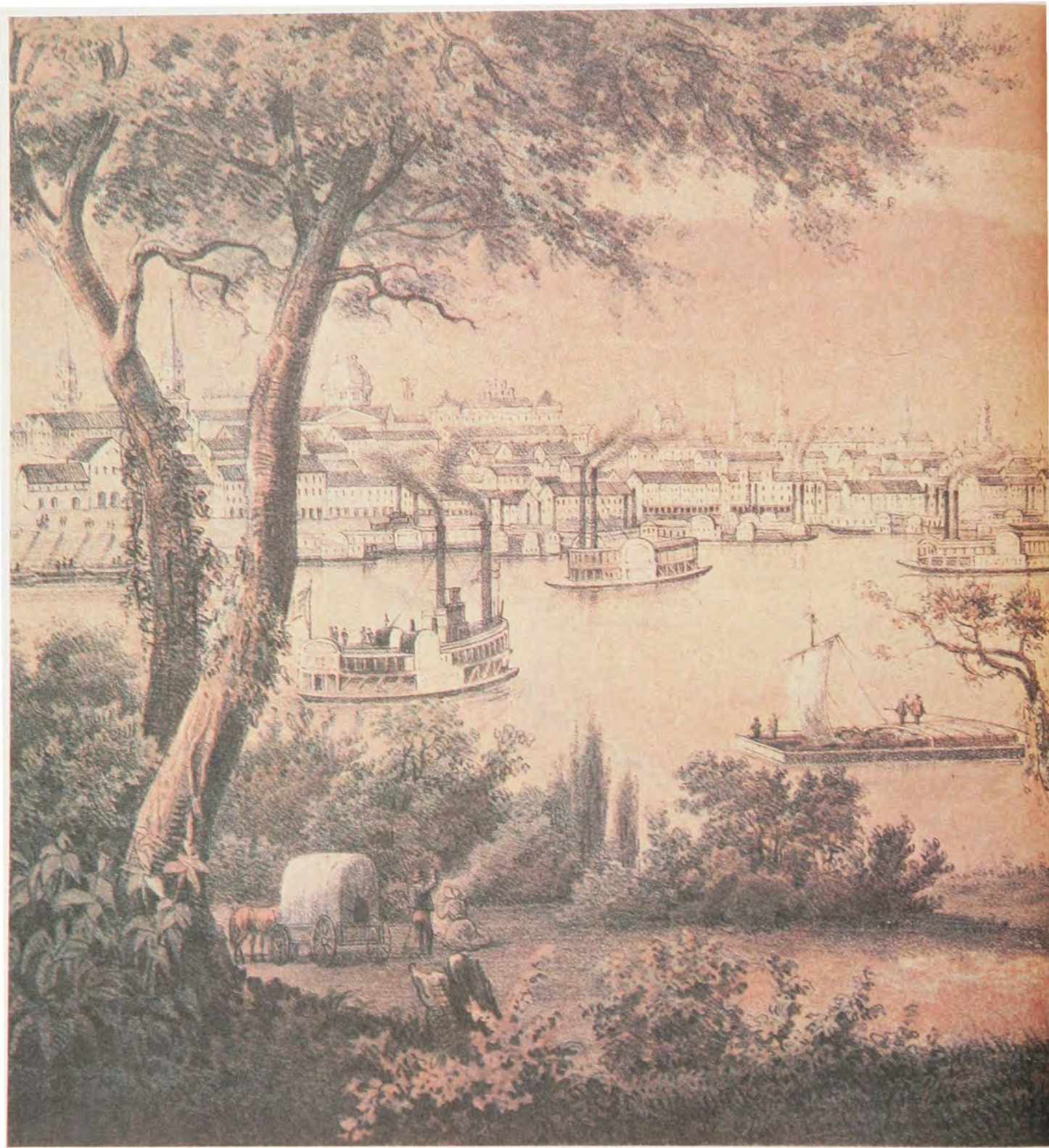


**River
Engineers
On The
Middle
Mississippi**

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River Engineers On The Middle Mississippi

**A History of the
St. Louis District,
U.S. Army
Corps of Engineers**

by Fredrick J. Dobney

—*St. Louis Art Museum*

View of St. Louis, 1835 by Leon Pomarede. The ferry in the foreground provided the only access to St. Louis from Illinoistown on the east side.

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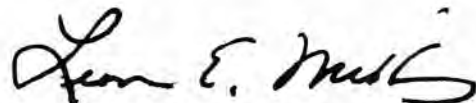
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Foreword

Waterways were the initial highways used by the pioneers in conquering our continental wilderness, and those same highways, developed and maintained, have provided the basic framework on which this great industrial nation has risen. Much like other major cities located along those great transportation arteries, St. Louis continues to depend on waterborne commerce for a large measure of its prosperity. The St. Louis Engineer District's past and future are inextricably meshed with the middle Mississippi River Basin which is the St. Louis Engineer District. This is the story of the District's people since 1837 and a reflection of the economic, environmental and sociological change in the region resulting from their work and guiding their work.

Throughout its history, the Corps' civil works mission, mandated by the people, has been to meet ever increasing demands to support a continually higher standard of living for more and more Americans. The 1960's saw the development of an increasing awareness by our people of their environment. Historically, the Corps has demonstrated a willingness to change, to address such needs that the public would support financially and politically. I am convinced that the keystone of our future as public servants must be on continuing responsive action in the public interest in whatever missions we are assigned.

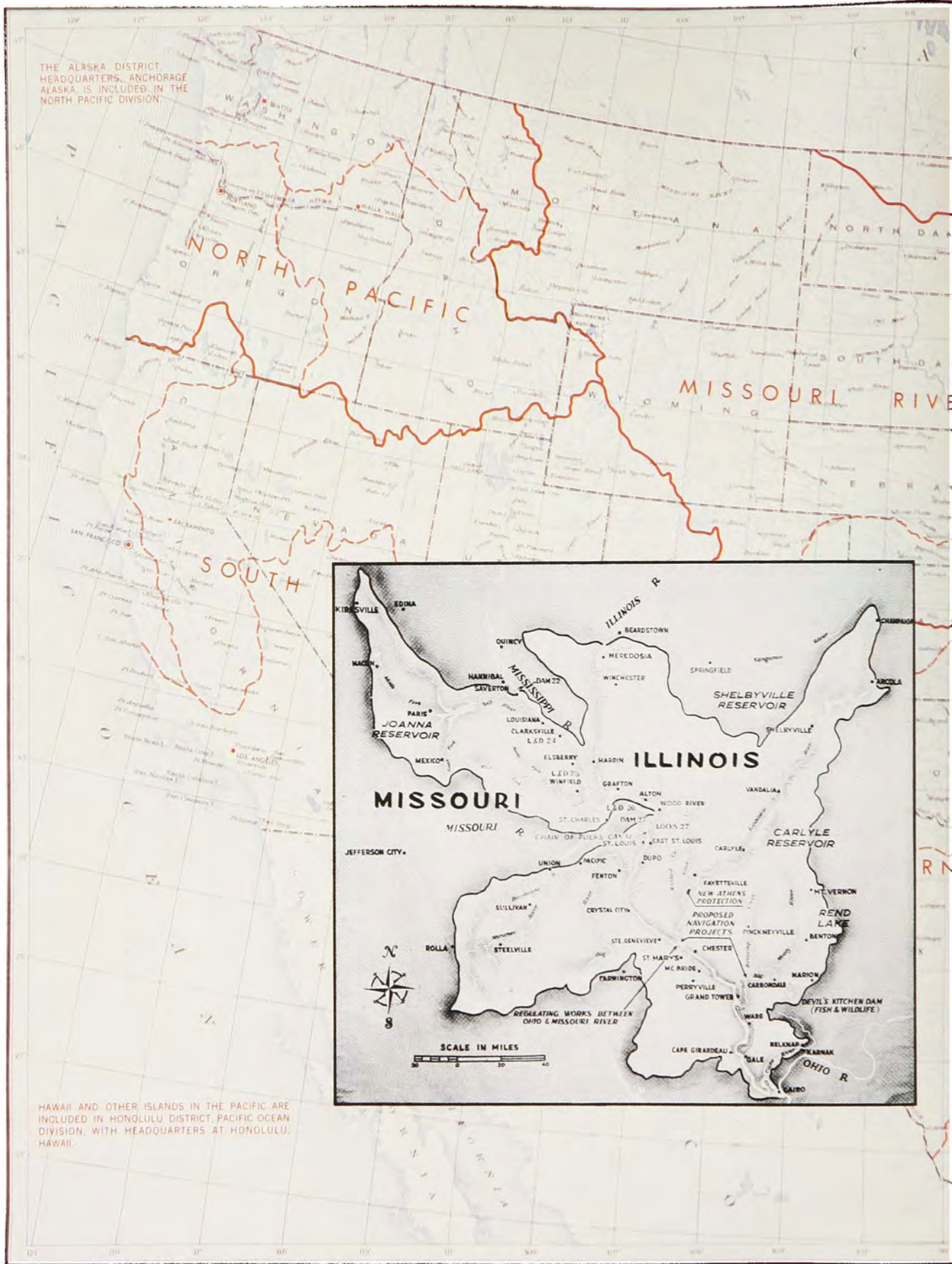
The St. Louis District's story contained in this volume proves once again that our past is prologue to our future and a cipher stone to our understanding the challenges yet to come.

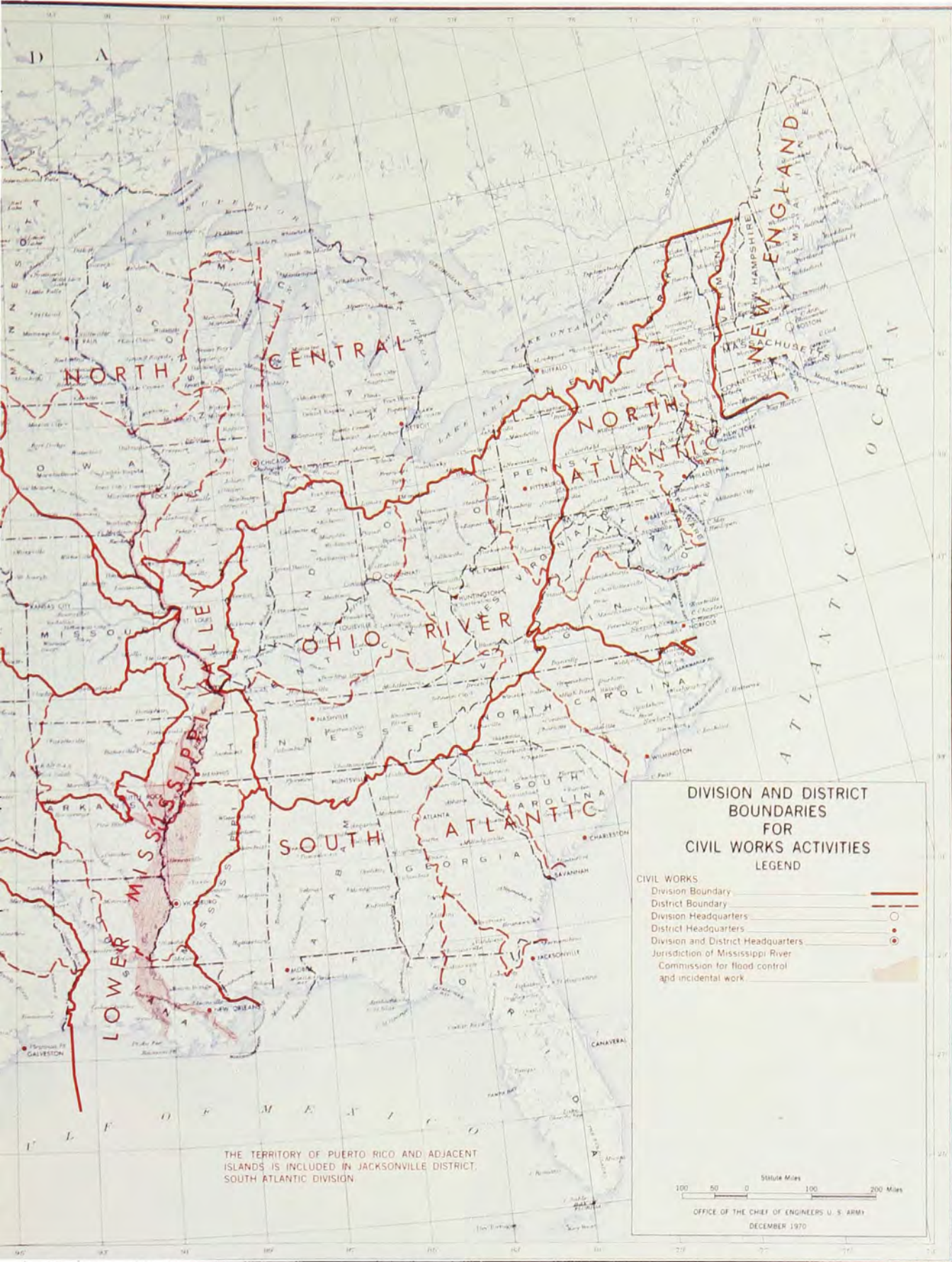


LEON E. MCKINNEY
Colonel, CE
District Engineer

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Preface

The history of the St. Louis region cannot be understood without an appreciation of its relationship to the Mississippi River. Since no organization has had a greater impact on the river than the Corps of Engineers, the history of the St. Louis District is to some extent also a history of the development of the region. Although my major task was to write the history of the District itself, I have tried in this volume, insofar as the constraints of a time deadline would permit, to demonstrate the District's interaction with the economic, demographic, and institutional development of the St. Louis area, as well as to show the relationship of District policies to the policies of the Corps of Engineers at the national level.

In addition, I formulated several other goals when I undertook this project. I approached the history of the District with no ideological axe to grind, pro or con, and was given carte blanche by the District officers. Under these conditions, I hoped to avoid the excesses of panegyric or jeremiad; I sought instead to weigh in with a fair assessment of the District's accomplishments. Another of my goals was to avoid a drab institutional history which recounted every action of the District since its inception. Rather, I attempted to describe the most important events in the District's history and fit them into the larger context of the region and the nation. Finally, although I tried to describe developments in construction technology and hydrological engineering, I did so in a fashion that would hopefully be comprehensible to a reader with no background in engineering. My fondest hope is that I have in some manner approximated these goals.

I could not have finished this book without the help of a number of people. I owe a particular debt of gratitude to Charlotte Siegfried, Benjamin Shearer, Professor Ronald DiLorenzo, John Waide, Rex Van Almsick, Rev. John Francis Bannon, S.J., Professor Martin Towey, and Dave Shocklee, all of Saint Louis

University, and to Professor Raymond Merritt of the University of Wisconsin-Milwaukee. In the St. Louis District office I received aid and comfort from Barbara Collier, Kenneth Long, Jack Niemi, Kathy Hayes, Elaine Greaving, Colonel Thorwald Peterson, Colonel Leon McKinney, Ulas Wilson, and Lieutenant Colonel Richard Gell. I also benefitted from discussions with Homer Duff, Gary Turner, Claude Strauser, William Remmert, Arthur Johnson, Tom Mudd, Lester Arms, Tom Hewlett, Tony Giardina, Bill Hoff, Bob Daniel, John Kilker, Ron Messerli, Mel Doernhoefer, and Russ Roberts of the District office. Former District employees contributed valuable information, too, including Max Lamm, Colonel Alfred D'Arezzo, Elmer Huizenga, Colonel Charles B. Schweizer, Colonel James B. Meanor, Jr., Colonel Rudolph E. Smyser, Colonel Guy E. Jester, Lowell Oheim, Robert Maxwell, Milton Mindel, and M. F. Carlock. In the Historical Division, OCE, I was treated magnificently by Dr. Jesse Remington, Lenore Fine, and Dr. Albert Cowdrey, all of whom gave unselfishly of their time and knowledge. The criticisms of Dr. Cowdrey were especially useful. The staffs of the National Archives and the Federal Records Center were quite helpful, as always. Thanks are due also to Gail Guidry and David Horvath of the Missouri Historical Society, Louise Walker of the St. Louis Art Museum, Arthur H. Ziern, Jr., Theodore Bruere of St. Charles Savings and Loan, and Irene Cortinovis of the University of Missouri-St. Louis. The layout of the book was done by a fine artist, Nell Kobes.

Finally, I would like to dedicate this book to my wife, Elaine, and my boys, Matthew and Eric, who had to live with me during the long and grumpy process of research and writing. Surely they have stored up treasure in heaven as a reward for their forbearance.

Fredrick J. Dobney

The Author

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Discovery of the Mississippi by Marquette, 1673 by J. N. Marchand.



—Missouri Historical Society

The Mississippi Valley: Formation, Exploration, and Settlement

The St. Louis District of the Corps of Engineers is situated on a crucial stretch of the Mississippi River; the District extends from a point just below Saverton, Missouri, 300 miles downstream to the mouth of the Ohio River. In the space of those 300 miles, the river is transformed from an unexceptional stream to the storied Mighty Mississippi. By the time the Mississippi leaves the St. Louis District it has assumed the characteristics which make it the most important river in America.

Yet the Mississippi was not always a mighty river. An examination of its geological genesis shows that only after the events of the Ice Age did it assume its present stature. Before the glaciers began creeping southward a million years ago, the Mississippi River flowed into the Gulf of Mexico over a different path, with what was probably a much smaller volume of water. Prior to the descent of the Kansan ice sheets onto the eastern and upper midwestern United States much of the present-day Missouri and Ohio Rivers flowed eastward and northward into Hudson Bay and the Gulf of St. Lawrence respectively. But the movement of the great glaciers permanently altered the drainage pattern of the midwest; the Missouri and Ohio Rivers became ice-marginal streams, that is, they flowed along the leading edge of the glacier, which had ground to a halt generally along the lines of those two riverbeds as they are now situated. Thus the Ohio and the Missouri became permanent parts of the Mississippi River system.



Known and inferred outer limits of four glacial stages in central North America.

The Mississippi was itself affected by the glaciation process. It had originally meandered across a wide range of the alluvial valley through which it flows; for example, it is likely that at one time the Mississippi flowed through at least part of the Illinois River's bed. Below St. Louis, the Mississippi had flowed along a much more westerly course until the glacial outwash (sediment deposited by melt water from the glacier) began forcing it toward the easterly path that it occupies today. Then, as the last glacier retreated, a huge lake formed in southern Canada and northern Minnesota. Lake Agassiz, which dwarfed the Great Lakes by comparison, was forced to flow southward into the Mississippi until the last glacier had retreated far enough to allow drainage to the north. For a time, the Great Lakes also drained into the Mississippi through the Illinois River. Thus during the period of glacial retreat the Mississippi realized a much greater volume of water than it has in postglacial times. The result of this massive runoff was to carve a wide flood plain the length of the Mississippi Valley. Shortly after the glacial period this valley was much deeper than it is today. During periods of extensive glacial melting it was not uncommon for the Gulf of Mexico to inundate the valley as far north as the confluence of the Mississippi and Ohio Rivers.¹

Thus did the third largest river basin in the world evolve (it is exceeded in size only by the Amazon and the Congo). The Mississippi basin contains fourteen times the area of the Rhine basin. The river itself is over 2200 miles long and its more than fifty navigable tributaries furnish about 15,000 miles of

navigable streams (and thousands of miles of unnavigable ones), traversing or bordering thirty-one states. Over one-half of the population and sixty-five per cent of the improved land in the United States are contained in the basin of the Mississippi. However, when the first white men saw the Mississippi, it was still part of an uncharted wilderness.²

The history of early explorations in the Mississippi Valley can be divided roughly into three periods. The 16th century found Spaniards searching for untold riches rumored to abound in the lands north of their colonies. But the rumors did not materialize in the discovery of gold or silver, and the northward thrust of Spanish exploration languished. During the 17th century, the French began to descend from their northern colonies, searching for a western passage to the Orient, and in the following century made many important contributions to the exploration of the American interior. With the acquisition of the Louisiana territory in 1803, American expeditions were sent out to determine the nature and breadth of the continent in as scientific a manner as possible.³

Before 1519, the Spanish apparently knew nothing of the Mississippi River. Spanish exploration in North America did not really begin until that date with Alonso Alvarez de Pineda's commission to colonize the northern Gulf Coast. Despite the opinions of some 19th century historians, Pineda probably passed the mouth of the Mississippi, but he did not discover the river. He did, however, name the Gulf Coast "Amichel" and claimed it for Spain. Pineda was killed



—Missouri Historical Society

Desoto Discovering the Mississippi River by G.C. Ividney.

by Indians on another voyage in 1520, but in 1526 Charles V granted to Panfilo de Narvaez the authority to conquer the northern Gulf Coast. Soon after, Narvaez reached Tampa Bay in April 1528, and he and his 300 men marched inland looking for gold. They failed to find any treasure; even worse, they failed to find their fleet waiting for them at St. Mark's. The men were forced to construct their own craft. Narvaez died and Cabeza de Vaca took command, leading the five boats through the easternmost mouth of the Mississippi. When de Vaca and only three other men returned after a sometimes harrowing exploration of Texas and surrounding states, he was hailed as a discoverer and a hero. But although he had discovered the immensity of the Northern lands, he had found the Mississippi only in passing. He noted in his journal that "we sailed that day until the middle of the afternoon, when my boat, which was the first, discovered a point made by the land, and against a cape opposite, passed a broad river."⁴

The discovery of the Mississippi River was iron-

ically the end of Spanish colonization efforts for almost 200 years. On May 1, 1539, Hernando de Soto sailed from Havana with Charles V's permission to conquer Florida. Having arrived at the Florida coast, de Soto and his men journeyed to what is now Tennessee where they came upon the "Rio Grande." One of de Soto's men, the so-called Gentleman of Elvas, noted that "the stream was swift, and very deep; the water, always flowing turbidly, brought along from above many trees and much timber, driven onward by its force." This would be a typical observation of the Mississippi for years to come.⁵

The Spanish had discovered the Mississippi, but the French opened the river and began to realize its importance. In 1634 Jean Nicolet skirted Lake Michigan from Three Rivers without seeing the Mississippi. He was searching for the Sea of China. The Indians among whom he stayed told him that the sea could be reached through the great river that was three days to the South. Why he did not pursue this information about the Mississippi is unknown. When Fr.

Claude Allouez founded a mission at La Pointe on the southern shore of Lake Superior, he came across some Indians who referred to the "Missipi" river, as Allouez spelled it phonetically, but he himself probably never saw the river. Allouez was replaced at La Pointe by Fr. Jacques Marquette in 1669. Marquette desired to find a way to the California Sea. When Louis Jolliet was sent out to explore the Mississippi by the governor of New France, he picked up Marquette to accompany him. On June 17, 1673, they sailed into the Mississippi and travelled to the mouth of the Arkansas, where they turned back in fear of increasingly hostile Indians and also because of concern about Spanish reprisals. In four months Jolliet and Marquette had traversed 2500 miles—the greatness of the Mississippi would no longer be mythical. Marquette may have even found the source of what de Soto had noticed before. Having passed by the "two painted monsters" high on the bluffs near Alton, Marquette wrote: "While conversing about these monsters, sailing quietly in clear and calm water, we heard the noise of a rapid, into which we were about to run. I have seen nothing more dreadful. An accumulation of large and entire trees, branches, and floating islands, was issuing forth from

the mouth of the river Pekistanoui [Missouri]."⁶

The entire length of the Mississippi was not sailed until 1681-82, by an exploration commanded by Rene Robert Cavalier, Sieur de La Salle, with Henri de Tonty and Fr. Zenobius Membre. In 1678 LaSalle was granted permission to explore the Mississippi and western trade routes, along with establishing forts where necessary. La Salle claimed the Arkansas and the lower Mississippi regions for France, yet the Red, the Ohio, the Missouri and the Arkansas rivers were still uncharted. In 1684 La Salle returned from France with a colonization party, but he missed the mouth of the Mississippi and was murdered by treacherous colonists before he could find it.

The French were quick to realize that a few forts were not enough—Louisiana had to be colonized. In 1698 Pierre Le Moyne, Sieur d'Iberville, set out from Brest with four ships. His party of 200 was the first French contingent to enter the mouth of the Mississippi, although they withdrew eastward and settled at Biloxi. Soon the Biloxi settlement moved to Fort St. Louis at Mobile as southern settlements began to disintegrate in favor of the more fertile lands around Kaskaskia, Peoria, and Vincennes in the Illinois country. Nevertheless, the French colonies grew.

By 1720 it became apparent that French speculation schemes in America were not yielding the expected riches, and French efforts at colonization continued at a slower rate after that time. But settlement did continue. In 1723 Etienne Bourgmond was commissioned to secure a fort on the Missouri. He built Fort Orleans in Carroll County, Missouri, about a hundred miles above the confluence of the Missouri with the Mississippi. The French also opened mines up and down the Mississippi. They had long mined copper in the north, but the old Spanish dreams of treasure did not go wholly unrealized downriver. M. la Renaudiere, who mined on the Meramec River, claimed that "I worked it [the rock] and found a little silver. In locations where the veins are well-formed, the mineral is found to be good, and produces as much as 40 to 50 percent." Many of the French mines were located around Kaskaskia, but apparently these mines did not yield a great deal of profit. Sieur



—St. Louis Art Museum

The Piasa Rock, Near Alton, Illinois from Das Illustrierte Mississippithal by Henry Lewis (1858)



—Missouri Historical Society

Map of French Louisiana, 1763.

Marc Antoine de la Loire des Ursins, who held a position at Fort Chartres similar to that of an Intendant, made an inspection tour of the mines in 1719. When he arrived at the village of Kaskaskia he noted that “you can imagine that the soldiers do not work at these mines, wherefore the sooner we shall get negroes the better it will be. The Frenchmen are unfit for this kind of work, and if they want to work, their wages will, in proportion, be much higher than the profit from the mines will permit.”⁷

As the 18th century progressed, the French gained little new knowledge of the Mississippi. Instead, narratives such as Mathieu Sagan’s persisted. In 1701 he claimed to have revealed a great secret—he had ascended the Mississippi, followed another stream to the southwest, and came upon the Acanibas nation, ruled by King Hagaren. These people were dressed in human skins and were horrible to look at (the men pressed their faces between boards from birth), but were quite mannerly. They traded, he supposed, with the Japanese. But perhaps even more

than such imaginative Frenchmen, troubles in Europe prevented France from devoting more money and interest to America. At the close of the Seven Years War, France was forced to cede Louisiana to Spain (1762), and as the Mississippi valley changed hands the fur traders became the important explorers in mid-America. These fur traders were not prone to keep journals, but the establishment of St. Louis in 1764 is one tribute to their prowess.⁸

The English too benefited from France’s losses in Europe; in 1763 England obtained the French empire in Canada. Among early English explorers were Jonathan Carver, who set out in 1766 to find the Pacific by exploring the Elk and the Minnesota Rivers; Samuel Hearne, who in 1771 went across Canada to the Arctic Ocean; and Alexander Mackenzie, who did the same in 1789 and 1793. Yet hopes remained for a western route farther south. The Spanish used St. Louis as a base for further exploration. In 1793 the Lt. Governor of Upper Louisiana, Zenon Trudeau, founded the Company of Explorers of the Missouri.



— *St. Charles Savings and Loan*

Lewis and Clark Leaving St. Charles, May 2, 1804
a mural depicting the beginning of the Lewis and Clark expedition.

Two expeditions were sent out, one in 1794 and another in 1795, but both failed due to Indian hostilities. A third, led by James Mackay, got as far as the Mandan villages, near present-day Bismarck, North Dakota.

English forays into the Mississippi Valley were foiled when hostilities began with the colonies. After George Rogers Clark took Vincennes in the campaign of 1778-79, American colonies began claiming boundaries all the way to the Mississippi River. In the 1783 Paris treaty, America and Britain agreed to free navigation of the Mississippi, even though Spain still claimed everything below $32^{\circ}30'$. This problem would be rectified by the Pinckney Treaty of 1795, which made the border between the United States and Louisiana the middle of the Mississippi. Spain was actually not in a position to enforce her claims, as Talleyrand proved in 1800 when Spain ceded Louisiana to France by retrocession. France once again possessed the vast Louisiana territory, but reverses in Haiti convinced Napoleon that he needed money more than American land. In 1803, the United States purchased Louisiana; the territory had changed hands for the last time.⁹

The Louisiana purchase led directly to American explorations of the West, mostly under the aegis of Jefferson. As early as 1782 Jefferson had shown keen interest in examining the western flora and fauna. On January 18, 1803, Jefferson proposed an expedition plan to Congress. Jefferson's private secretary, Captain

Meriwether Lewis was chosen to lead it. Lewis in turn chose William Clark to assist him. Lewis and Clark embarked from Pittsburgh on August 31, 1803, and from St. Louis on May 14, 1804; they reached the Pacific on November 7, 1805. Lewis's orders had stated that "the object of your mission is to explore the Missouri River, and such principal streams of it, as, by its course and communication with the waters of the Pacific ocean . . . may offer the most direct and practicable water-communication across the continent, for the purposes of commerce." Lewis's main objective was not the Mississippi, for Jefferson had envisioned separate expeditions to explore the principal waters of the Missouri and the Mississippi.¹⁰

The War Department followed the President's lead and became involved in westward expansion and exploration. Zebulon Pike was sent out in August of 1805 to explore the source of the Mississippi and its main tributaries, but failed to find the true source. His most famous exploration left St. Louis on July 15, 1806, and headed for the southwest.

With the publication of Lewis and Clark's maps in 1814, interest in the West increased. As fur traders opened up the river systems, the military frontier continued to push on. The Mississippi valley was ripe for scientific investigation. The Topographical Engineers, a part of the Corps of Engineers which was newly revitalized after having been abandoned after the War of 1812, could provide men to carry out these investigations.



—Independence National Historical Park Collection

Stephen Harriman Long from a portrait by Titian Ramsey Peale.

Stephen Harriman Long had applied for a commission in the Topographical Engineers after a stint on the mathematics faculty at West Point. He was sent to St. Louis with the brevet rank of major, and, in his first assignment that concerned exploration, he examined topographical features around Lake Peoria and the Illinois River in search of a site for a fort which was never built. Later, in 1816, he sailed from St. Louis to Chicago and Fort Wayne, noting places where canals might be desirable. In June of 1817, Long made a voyage to the Upper Mississippi and the Wisconsin, during which he again recorded topographical information. In 1819, with the help and blessing of Secretary of War John C. Calhoun, Long built the "Western Messenger," a steam-powered ship, which may have anticipated Henry Shreve's innovations, designed to carry an exploration party to the West. The Yellowstone Expedition left St. Louis on June 21, 1819, eventually following the Platte and the South Platte to the Rockies. This expedition succeeded in bringing back significant topographical information about the Southwest.¹¹

Thus explorers had provided important knowledge and impetus for the eventual settlement of the

Mississippi Valley and the vast lands beyond. But too often explorers have been glorified at the expense of the people who brought civilization into the wilderness—the settlers. These pioneering souls engaged in the arduous, and sometimes tedious, task of carving out an existence in perilous proximity to dangers seemingly of every kind. Indians, wild animals, disease, weather, hunger—it was the day-to-day battle with these importunate foes that ultimately proved most important in determining the future development of the midwestern and western states.

The first permanent white settlements in the St. Louis District were the French outposts in southwestern Illinois. In 1699 the Seminary for Foreign Missions founded a mission at Cahokia to minister to local Indians; a year later the Jesuits transferred Father Marquette's Mission of the Immaculate Conception to Kaskaskia. By 1733 these villages had been joined by settlements at Fort Chartres, St. Philips, and Prairie du Rocher. Although the original impetus for settlement was religious, the villages survived and grew because of the fur trade of the Northwest. The settlers discovered too that they were situated on a fertile bottomland well suited to agriculture. When the glaciers had retreated at the end of the Ice Age, they had left Illinois with some of the flattest and richest farm land in the world. As a result, the settlers not only supplied their own needs, they also became important as exporters of grain to New Orleans and other parts of Louisiana. Nevertheless, life on the frontier was difficult; the number of inhabitants grew slowly and never became very large. The population in the eighteenth century probably never exceeded 2500.¹²

On the Missouri side of the river, although lead mining occurred as early as 1719, the first permanent community, Ste. Genevieve, did not appear until about 1735. For a time it seemed that Ste. Genevieve was destined to play a preeminent role in the development of Missouri and the West, but events would prove that the choice of the village's site had been a poor one. The settlement was subject to inundation by the Mississippi and was too far from the mouth of the Missouri River, source for much of the fur trade.¹³



— Missouri Historical Society

Founding of St. Louis (February 14, 1764) by August Becker.

Pierre Laclede and Auguste Chouteau, on the other hand, chose a superb site for their new settlement in 1764. The village they named for King Louis IX of France was built on a limestone bluff jutting up from the Mississippi. Not only was this site safe from the ravages of the rampaging river, but it also stood upon the first elevated spot south of the junction of the three great rivers, the Illinois, the Mississippi, and the Missouri. A party under the direction of Laclede began felling trees and constructing shelters on February 15, 1764. The birth of this new settlement would ultimately inscribe the epitaph for Ste. Genevieve's hopes for future greatness.¹⁴



—Missouri Historical Society

Pierre de Laclede Liguest



—Missouri Historical Society

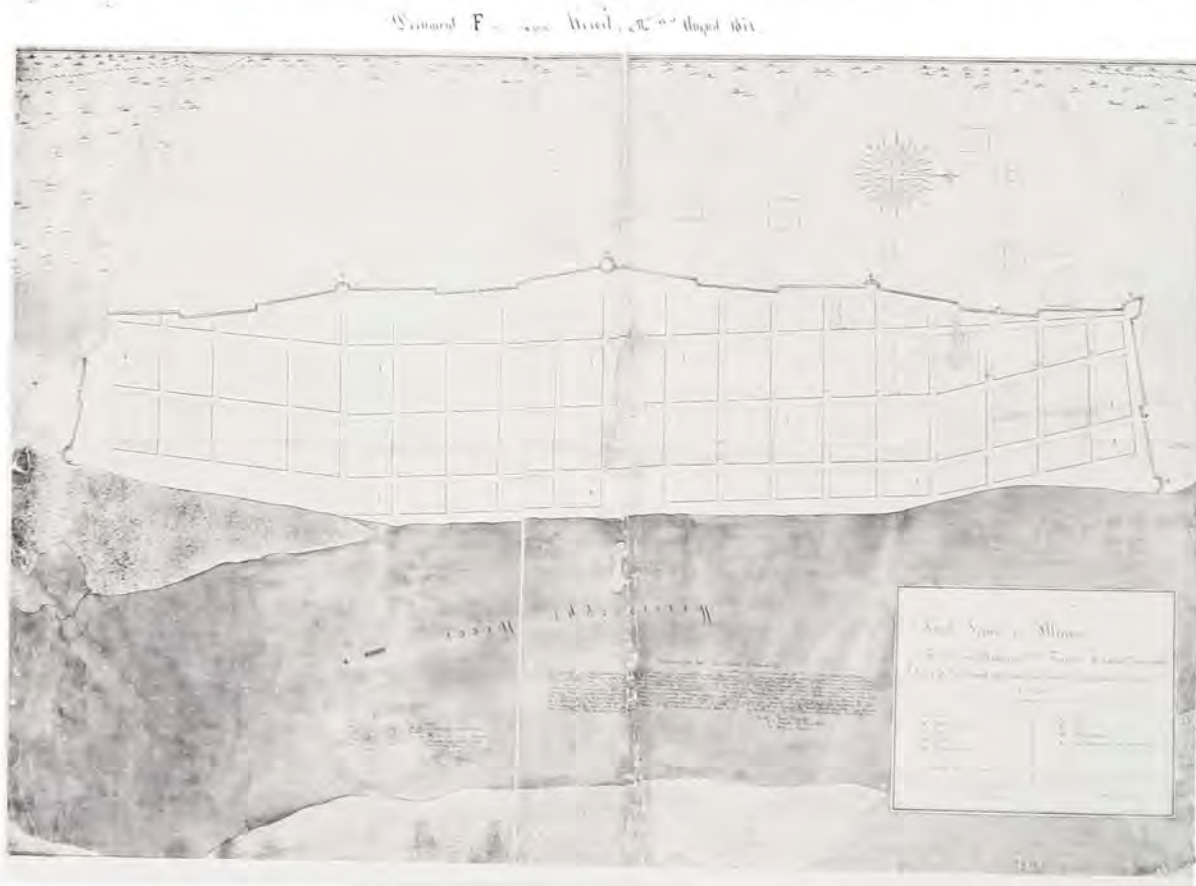
Auguste Chouteau

The motivation for construction of St. Louis was pecuniary: the French government in North America had granted an exclusive privilege to Maxent, Laclede, and Company for trading with the Indians on the Missouri River. Such a concession promised lucrative rewards in the fur trade. Although conditions in St. Louis were far from perfect—"the greater part of the settlers, lived for a time on scaffolds, elevated six or seven feet above the ground, to protect themselves from the wild beasts which abounded," and the threat of Indian attack created a constant state of anxiety—other factors augured well for the future of the new settlement. France had ceded all her territory east of the Mississippi to England in the 1763 Treaty of Paris, and although it would take two years for the English to assume control of the Illinois garrisons, many French settlers moved to French territory west of the Mississippi when the opportunity presented itself.¹⁵

By October 1765 St. Louis had about fifty families. Actually, by the time most of these families moved to St. Louis, they were leaving English territory to live in Spanish territory—France had ceded its Louisiana holdings to Spain in 1762. Whether anyone in St. Louis knew about the cession before the bulk of the families moved there is a matter of conjecture; communications were extremely slow and the area of the St. Louis District was virtually at the other end of the world from France and Spain. In any event, the cession made little practical difference since the Spanish had only a slight impact on the French character of the Missouri settlements. The Spanish instead devoted their energies to exploiting their Mexican territory, which they considered more

valuable. As a consequence, the French settlers and traders enjoyed a western counterpart of "salutary neglect."¹⁶

While the Spanish were neglecting Missouri, the English were doing much the same in Illinois. Other than demolishing Fort Chartres in 1772 and establishing Fort Gage at Kaskaskia, the English accomplished very little in Illinois, and with the outbreak of the American Revolution they lost all real control of the area. During the Revolution, the French inhabitants of Illinois appear to have managed their own affairs. In 1779 they were joined by the first Americans to make permanent homes in Illinois, and the Americanization of the area was underway. It would, however, be a long, slow process; surviving evidence indicates



—Missouri Historical Society

Auguste Chouteau's Map of Saint Louis, 1780



—Missouri Historical Society

Indian Attack on the Village of Saint Louis 1780 from a mural in the Capitol Building, Jefferson City, Missouri, painted by Oscar Berninghaus.

that by 1800 the 2500 Illinoisans were almost evenly divided between French and American. Although the 1783 treaty marking the end of the Revolution provided that Illinois was now American soil, according to one historian it was not until 1816 that the United States would “enter on full possession of her mighty empire.” In the meantime, the Illinois side of the St. Louis District would be less important than the Missouri side.¹⁷

The number of settlements in Missouri underwent a considerable expansion during the late eighteenth century, as St. Charles, Florissant, New Madrid, and Cape Girardeau were established. The lure of the fur trade obviously outweighed the threat of Indian attack (which was greatly exaggerated anyway), although the events of 1780 must have given prospective settlers reason to reconsider. In that year St. Louis had a population of about eight hundred, mostly French, although some Spanish bureaucrats and soldiers were included among their number. When Spain joined

France in supporting the Americans against the British, the British determined that they should try to regain control of the Northwest. To achieve that end, Captain Emanuel Hesse mobilized a force of about 950 Indians and Canadian trappers for an attack on St. Louis. The attackers were driven off, but one historian has estimated that St. Louisans suffered as many as one hundred casualties in the attack. Even though this was not an Indian attack in the traditional sense of the phrase, it contributed to St. Louis’s reputation as a wild and dangerous place to live, and may have retarded settlement for a time.¹⁸

Although this event illustrated a seeming disadvantage of St. Louis, the “year of the great waters” clearly proved the superiority of St. Louis’s location on the Mississippi. In April 1785 the Mississippi displayed its awesome power, rising thirty feet above the highest water mark known, virtually eradicating Kaskaskia, and inundating the eastern shore of the river and the settlements thereon, as well as Ste. Genevieve on the western bank. The river had served notice that it could not be taken for granted, and almost two hundred years later inhabitants of the Mississippi valley would still find themselves in an adversary relationship with its raging waters.¹⁹

The clear superiority of the Missouri side of the river for commerce (especially St. Louis) explains why, by 1800, it had outstripped Illinois in terms of population. St. Louis had 925 inhabitants (including 268 slaves); Ste. Genevieve, 949; St. Charles, 875; New Madrid, 782; and Cape Girardeau, 521. The majority of St. Louisans were still French, and they undoubtedly would have been pleased had they known of the secret retrocession of Louisiana which transpired on October 1, 1800. Less than three years later, in a transaction which assured America's future expansion, France sold Louisiana to the United States for fifteen million dollars. Louisiana included some 828,000 square miles and virtually doubled the size of the United States. Yet even though the Louisiana Territory was now officially part of the United States, Missouri did not grow very fast; in 1810 there were only 1000 people in St. Louis. Like Illinois, Missouri would not really flourish until after the War of 1812.²⁰



—Missouri Historical Society

Louisiana Transfer by F. L. Stoddard

In 1810 Illinois had a population (including Wisconsin) of 12,282. But the population experienced a tremendous growth after the close of the War of 1812. According to historian Theodore Pease, "population flooded into the territory. By 1818 it seemed quite possible that statehood was attainable," and indeed, on December 3 of that year Illinois was admitted to the Union. By 1820, Illinois had a population in excess of 55,000. Kaskaskia enjoyed a brief stint as capital of the new state, but in 1820 the capital was removed to Vandalia where it would stay until 1839.²¹

Missouri followed closely behind, achieving admission as a state on August 10, 1821. While the Illinois section of the St. Louis District continued to have primarily an agricultural economy, St. Louis had established itself as the commercial leader of the two-state area. In the year of admission, St. Louis had 9732 people (mostly Americans) in the immediate urban area and had property within the city valued for tax purposes at almost a million dollars.²²

That property valuation reflected the increasing importance of St. Louis as a commercial center. An excellent indicator of the rate of this growth is provided by the fact that, by 1841, the amount of property taxed would skyrocket to \$8,591,675. A combination of three events heralded the beginning of this extraordinary growth: the admission of Illinois and then Missouri to the Union, and the arrival of the first steamboat in St. Louis in 1817. The juxtaposition of statehood and concomitant governmental aid to navigation with the technological development of the steamboat would open great new vistas for St. Louis commerce.²³

The character of St. Louis commercial endeavors had been fairly constant in the years prior to statehood. The fur trade remained the most important economic activity even after statehood, because St. Louis's advantageous geographical location made it the logical commercial center for the fur trade of the entire Missouri valley and most of the upper Mississippi as well. St. Louis owed its founding to the lure of the fur trade, of course, and during the years of Spanish occupation the fur trade remained preeminent in the



—Missouri Historical Society

Type of flatboat used on western rivers, 1796

economy. But the real stimulus to the fur trade was provided by the Lewis and Clark expedition, which opened the door to the great Northwest for fur traders, revealing the untapped wealth of pelts to be had in that vast territory. The impact of the expedition was more evolutionary than immediate, but the floodgates had swung wide and it was only a matter of time until St. Louis would be inundated by the traffic in furs.²⁴

The fur trade received a temporary setback during the War of 1812, but it revived after the Treaty of Ghent. Historian Edwin C. McReynolds has written that "by 1819, fifteen hundred buffalo hides were being delivered in St. Louis annually." The total value of furs coming to St. Louis between 1815 and 1830 was estimated by Indian agent John Dougherty at \$3,750,000, almost evenly divided among beaver skins, buffalo skins, and miscellaneous peltries (otter, muskrat, deer, and raccoon skins). Trapping increased rapidly after Missouri became a state and did not begin to decline until the 1840s.

The second most important resource in St. Louis commerce was lead, which was mined in Missouri, Illinois, and Wisconsin, and then transhipped through St. Louis. Although lead mining in Missouri dated back to 1719, it was in the first half of the nineteenth century that it achieved its greatest relative importance. Lead was not only an important commercial commodity in itself, but it also, more than other factors, stimulated the growth of steamboating on the Upper Mississippi during the years 1828-1848. Steamboating, in turn, became one of the most important reasons for St. Louis's commercial success in this period. A commercial center had to have reliable and rapid transportation to compete successfully; the steamboat filled that need for St. Louis. Prior to the advent of the steamboat, a round-trip from Ohio to New Orleans by barge had taken close to a year. A keelboat could traverse the distance from Louisville to New Orleans in six weeks, but the return trip required eighteen weeks. By way of contrast, in 1844

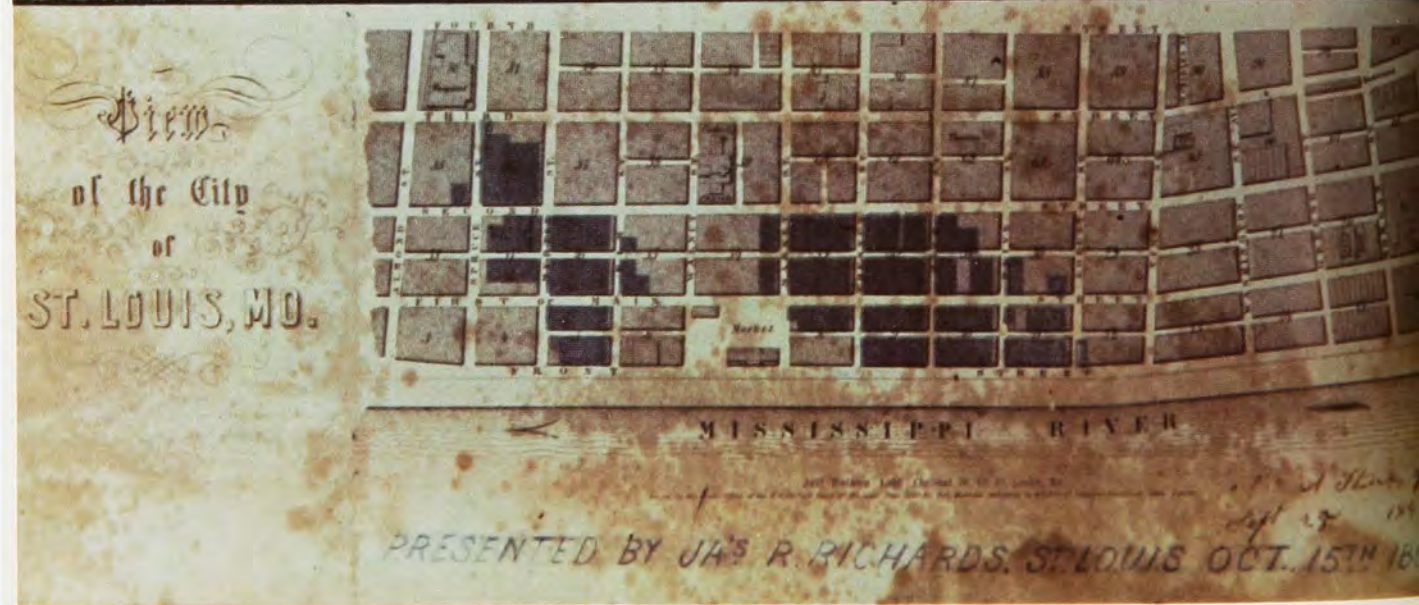
the *J.M. White* made the round trip between St. Louis and New Orleans in nine days. Even though the western steamboats probably averaged under ten miles an hour round-trip in normal circumstances, they had made possible economical upriver trade and substantially reduced transport costs both up and down the river. St. Louis would, as a result of the advent of the steamboat, grow and prosper as the distribution center for Eastern goods in the Midwest and the shipping point for goods bound from the Midwest to "the outside world." It appeared that the St. Louis economy was destined to revolve around commerce; although efforts were made to lure manufacturing to the St. Louis area, in the pre-Civil War period steamboat traffic would be the lifeblood flowing through the arteries of the Mississippi, Ohio, Illinois, and Missouri Rivers.²⁶

The lead trade provides an excellent example of the economic impact of the steamboat and river traffic in general. According to Edwin C. McReynolds, "In 1818 the average cost of transportation from the lead mines at Potosi or Mine a Breton to Herculanum, distances under forty miles, was seventy-five cents per hundredweight, whereas, the cost of transporting an equal weight one thousand miles by steamboat, from

the river port to New Orleans was seventy cents." By 1822, there were between 33 and 45 active lead mines in Missouri, and they not only kept the steamboats occupied with lead shipments, but they also attracted to the lead-mining areas thousands of immigrants, most of whom made all or part of the journey by steamboat. Like the fur trade, the lead trade would increase in volume and importance until about the time of the Mexican War. However, by the beginning of the Civil War, the lead trade had not only degenerated, it had virtually disappeared. Nevertheless, the appearance and growth of the steamboat traffic in St. Louis paralleled an unprecedented growth and prosperity in the St. Louis region. Obviously, as St. Louis became more dependent on the steamboat to maintain its rate of growth, it became incumbent on St. Louis merchants to assure the free flow of river traffic on the upper Mississippi and the accessibility of the St. Louis harbor. In pursuing those goals St. Louis would have its first encounters with representatives of the U.S. Army Corps of Engineers; Henry Miller Shreve and Robert E. Lee would each contribute substantially to the economic welfare of St. Louis.²⁷

Footnotes Chapter 1

1. For a fuller discussion of the geological formation and characteristics of the Mississippi Valley, see J. H. Paterson, *North America: A Geography of Canada and the United States* (London, 1967); Frederick B. Loomis, *Physiography of the United States* (New York, 1937); William D. Thornbury, *Principles of Geomorphology* (New York, 1969); Richard Foster Flint, *Glacial and Pleistocene Geology* (New York, 1957); Richard Foster Flint, *Glacial and Quaternary Geology* (New York, 1971).
2. William J. Peterson, *Steamboating on the Upper Mississippi* (Iowa City, 1968), 26-27; Arthur D. Frank, *The Development of the Federal Power of Flood Control on the Mississippi River* (New York, 1930), 47. The term "Mississippi" comes from the Ojibway Indians and means "great river." It was incorrectly translated by an imaginative Frenchman as "Father of Waters." An early mapmaker, Jonathan Carver, used the present spelling on his maps, and later writers and cartographers have accepted his version. See Peterson, *Steamboating*, 11-12.
3. For a full discussion of the period up to 1803, see Frederic Austin Ogg, *The Opening of the Mississippi: A Struggle for Supremacy in the American Interior* (New York & London, 1904), and John Francis Bannon, *History of the Americas* (New York, 1963).
4. J. Franklin Jameson, ed., *Spanish Explorers in the Southern United States, 1528-1543* (New York, 1907), 41.
5. *Ibid.*, 204.
6. Louise P. Kellogg, ed., *Early Narratives of the Northwest, 1634-1699* (New York, 1917), 249. Three Rivers was located on the St. Lawrence River between Quebec and Montreal.
7. Quoted in J. H. Schlarman, *From Quebec to New Orleans* (Belleville, Ill., 1929), 205.
8. See Francis Parkman, *The Works of Francis Parkman*, vol. 5: *La Salle and the Discovery of the Great West* (Boston, 1902 (1869)), 486-87.
9. See E. W. Gilbert, *The Exploration of Western America, 1800-1850; An Historical Geography* (Cambridge, England, 1933), 5-6.
10. See Cardinal Goodwin, *The Trans-Mississippi West, 1803-1853; A History of Its Acquisition and Settlement* (New York, 1967 (1922)); Meriwether Lewis, *History of the Expedition Under the Command of Captains Lewis and Clarke*, 3 vols. (New York, 1922), 1:xxxiv.
11. For a discussion of the Topographical Engineers, see chapter two. Also see Richard G. Wood, *Stephen Harriman Long, 1784-1864; Army Engineer, Explorer, Inventor* (Glendale, 1966), 42-43.
12. Theodore Calvin Pease, *The Story of Illinois* (Chicago, 1949), 9-11.
13. Edwin C. McReynolds, *Missouri: A History of the Crossroads State* (Norman, 1962), 16-18.
14. Richard C. Wade, *The Urban Frontier: The Rise of Western Cities, 1790-1830* (Cambridge, Mass., 1959), 3; John Francis McDermott, ed., *The Early Histories of St. Louis* (St. Louis, 1952), 31-32.
15. McDermott, *Early Histories*, 31-32; John A. Paxton, "Notes on St. Louis," in McDermott, *Early Histories*, 63-64; Wilson Primm, "History of St. Louis," in McDermott, *Early Histories*, 111; Pease, *Story of Illinois*, 14; McReynolds, *Missouri*, 20.
16. McDermott, *Early Histories*, 33-34; J. N. Nicollet, "Sketch of the Early History of St. Louis," in McDermott, *Early Histories*, 152-53.
17. Pease, *Story of Illinois*, 32-33, 41-49, 70.
18. McDermott, *Early Histories*, 35-36; McReynolds, *Missouri*, 21-25; Wade, *Urban Frontier*, 4, 59.
19. Primm, "History of St. Louis," 125-26; Nicollet, "Sketch of Early History," 151.
20. Wade, *Urban Frontier*, 4; McReynolds, *Missouri*, 25; McDermott, *Early Histories*, 37; Pease, *Story of Illinois*, 74-76.
21. Pease, *Story of Illinois*, 74; Paul M. Angle, ed., *Prairie State: Impressions of Illinois, 1673-1967, By Travelers and Other Observers* (Chicago, 1968), 59-60.
22. McDermott, *Early Histories*, 39; Paxton, "Notes on St. Louis," 69-71.
23. Nicollet, "Sketch of Early History," 162; Florence Dorsey, *Master of the Mississippi* (Boston, 1941), 219.
24. Wade, *Urban Frontier*, 60-61; McReynolds, *Missouri*, 70; Paxton, "Notes on St. Louis," 72-73; Mildred Hartsough, *From Canoe to Steel Barge on the Upper Mississippi* (Duluth, 1934), 63-64; Peterson, *Steamboating*, 147.
25. McReynolds, *Missouri*, 70, 107-11.
26. Wade, *Urban Frontier*, 61-64, 70-71, 200-202; Hartsough, *Canoe to Steel Barge*, 66; George Rogers Taylor, *The Transportation Revolution, 1815-1860* (New York, 1951), 138-59; Peterson, *Steamboating*, 46, 209, 246-47.
27. McReynolds, *Missouri*, 66-67; Peterson, *Steamboating*, 246-47; 297-98; Hartsough, *Canoe to Steel Barge*, 67.



The Great St. Louis Fire, 1849 by L. Gast.

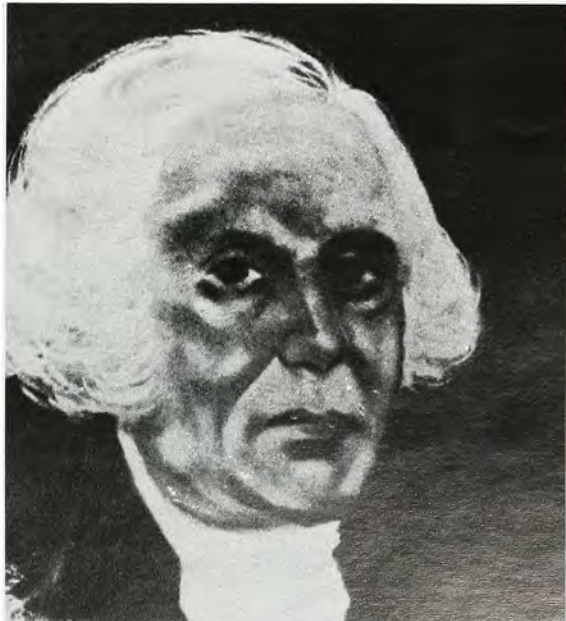
On May 17, 1849, a fire broke out on the steamboat *White Cloud*. Within half an hour it had spread to 23 steamboats, then to cargo on shore, and, finally, to buildings on the riverfront. Ultimately, over \$5-1/2 million in property was destroyed.

The Golden Age of the Steamboat

The lineage of the United States Army Corps of Engineers dates back to June 16, 1775, when General George Washington appointed Colonel Richard Gridley as Chief Engineer for the Continental Army. For the first three years, Gridley had only other engineer officers under his command, but in March 1778 engineer troops were also designated, to serve as the instruments for carrying out engineering plans. At this time, the term engineer was used rather loosely; America was (and would remain for fifty years) at a primitive stage of engineering development. Some frontier surveyors and European engineers had achieved a higher state of the art, but in general the American Engineers tended to be practical men who worked by "rule of thumb" rather than by engineering theory.¹



—Missouri Historical Society



Colonel Richard Gridley
America's first Chief Engineer.

The Engineers made their most important contribution to American success during the Revolutionary War by constructing the siege works at Yorktown in September 1781; these siege works were in large part responsible for the defeat of the British. Two years later, after the Treaty of Paris (recognizing American independence) had been signed, the Continental Army Corps of Engineers was disbanded. But in 1794 Congress recognized the need for some such organization on a continuing basis when it established the Corps of Artillerists and Engineers. That group was abolished in 1802 and replaced in the same act by the present Corps of Engineers; the act also established an associated military academy located at West Point, New York. In fact, the act read in such a way that the Corps and the Academy were identical, stipulating that the Corps "shall be stationed at West Point . . . and shall constitute a military academy" and further naming "the principal engineer" as superintendent of the academy. Quite in keeping with the spirit of the Engineers at the time, the first superintendent, Jonathan Williams, was more a scientist than a soldier. The academy was the first engineering school in America and would remain the only one until 1824 (when Rensselaer Polytechnic Institute was founded). West Point would remain under the control of the Corps of Engineers until 1866.²



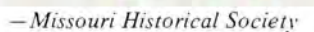
Colonel Jonathan Williams
first superintendent of West Point.

In 1812 the Corps of Engineers added sixteen Topographical Engineers, who served during the war against the British. Following the conclusion of the peace treaty in 1815, the Topographical Engineers were discharged, but the positions were reinstated a year later. After considerable controversy and confusion concerning the chain of command, the Secretary of War in 1831 established the Topographical Bureau as a separate and independent office within the War Department. In 1838 Congress established a separate Corps of Topographical Engineers, and in that same year it was decided that the Topographical Engineers would be responsible for all civil works. The Topographical Engineers were charged with surveying roads, canals, lakes, rivers, and harbors and with gathering topographical and geographical data. During the Civil War, this division of the Engineers into two autonomous units proved ill-suited to the needs of wartime, and the Topographical Corps was abolished and its engineers returned to the jurisdiction of the Chief of Engineers in 1863.³

The earliest mission of the Engineers in the St. Louis District, related to improvement of navigation, began shortly after the admission of Missouri to statehood. Prior to the coming of the railroad, the St. Louis District relied almost exclusively on the rivers for communication and commerce. Yet transportation on western rivers in the early nineteenth century was extremely hazardous. Rapids, rocks, bars, and snags posed grave threats to navigation. Of the four, snags were far and away the most perilous because they were hardest to detect and because they dotted the entire length of many western rivers.⁴

Snags came in several varieties: "planters" were trees which had become embedded in the stream bottom and then been reinforced by tons of silt settling about them; "sawyers" were logs which played up and down in response to the pressure of the stream; "rafts" were large numbers of logs which became entangled against a bar or some outcropping from the shore. Snags resulted from the crumbling of river banks when the streams flooded, or shifted course, or simply eroded their banks; trees were con-

Advertisement of the expected arrival of the steamboat *Pike* at St. Louis, 1817, from the *Missouri Gazette*.



If St. Louis was to become an important commercial center, such perils would have to be eliminated, or at the very least mitigated. Neither Missouri nor Illinois had the requisite resources to clear the Mississippi and its tributaries within their state boundaries; nor did they have the jurisdiction to clear the Mississippi beyond their own territory. Obviously it was a problem which required the attention of the federal government. Yet at the national level a sharp rift between those who subscribed to a strict construction of the Constitution and those who favored a broad interpretation created a controversy about whether internal improvements ought to be financed by the federal government. Although Presidents Jefferson, Madison, and Monroe favored a federal role in internal improvements, all three believed that a strict construction of the Constitution would not permit such expenditures unless a Constitutional amendment was adopted. Congressional leaders John C. Calhoun of South Carolina and Henry Clay of Kentucky, on the other hand, saw internal improvements as a legitimate and necessary function of the federal government. In 1819, Calhoun, by now Monroe's Secretary of War, submitted a "Report on Roads and Canals" to the House of Representatives in which he maintained that "military and civilian needs were indistinguishable from each other and that Federal aid to these improvements was indispensable to their completion." Perhaps even more telling than the military argument, however, was the



19



—St. Louis Art Museum

Raftsmen Playing Cards, 1847 by George Caleb Bingham.

economic one. With the rapid growth of the West, new markets for goods opened up, and potential suppliers clamored for a means of making those goods available. The demand for products and the search for markets were powerful factors militating in behalf of a federal role in internal improvements.⁶

The year 1824 was a watershed in the development of internal improvements—for one thing, Congress passed a General Survey Bill, “the evident purpose of which,” according to historian George Dangerfield, “was to prepare the way for a program of appropriations for internal improvements on a national scale.” This Act addressed only roads and canals, but it set an important precedent for other internal improvements measures, including the first River and Harbor Act, which was also passed in 1824. Another important event in that year was the Supreme Court ruling in *Gibbons v. Ogden*, in which the Court denied the right of any one company to monopolize the use

of the steamboat. That ruling swung wide the gates of opportunity to those hardy entrepreneurs who were willing to take their chances on the western rivers, and the result was a boom in travel and transportation and a concomitant demand for internal improvements. Thus 1824 marked the beginning of large-scale Federal involvement in internal improvements, although that involvement would not be constant and would continue to excite opposition on constitutional grounds.⁷

Political and economic leaders in the West in general and in St. Louis in particular were not impressed by constitutional arguments. They had a need, and the federal government was the only entity that could satisfy that need. They welcomed governmental aid in improving navigation, whatever the constitutional subtleties. The government’s earliest activity in the St. Louis area was reflected in an 1821 report of the Board of Engineers which identified the problems

presented by snags on the Ohio and Mississippi Rivers and suggested that the snags problem could be overcome. When, in 1824, Congress passed the first River and Harbor Acts giving the Corps of Engineers the responsibility for improvement of seaports and internal waterways, the bill contained a \$75,000 appropriation to improve navigation on the Ohio and Mississippi Rivers.⁸

The federal government was not indifferent to the threat to navigation posed by snags. In 1824 Secretary of War John C. Calhoun sent a circular letter to all western steamboat captains inquiring how snags could be removed from western rivers. One of the first to respond was Henry Miller Shreve, truly a significant force in the development of the western steamboat, who replied that he had invented a steam vessel for just that purpose three years earlier. For some reason Shreve never received a reply. Instead, the War Department issued another circular, offering \$1000 for the best plan or machine for snag removal. Having been ignored once, Shreve now ignored the new circular in turn. As a result, the first contract for snag removal was awarded to John Bruce of Kentucky, in October 1824. Bruce's plan was to use a "machine

boat" that he had developed. This boat consisted of two flatboats placed in parallel about eight to twelve feet apart and joined by cross timbers supporting a long wooden lever. Through a combination of lever and windlass, the machine boat was capable of raising many snags, boulders, and other obstructions from the river, but it was a slow process. Bruce had been given a charge to clear the Ohio and Mississippi Rivers; he never reached the Mississippi. Bruce quit after a relatively short tenure and was replaced by Judge Samuel McKee, who died shortly thereafter. In the meantime, Shreve had come to the attention of the War Department, and on December 10, 1828, Secretary of War James Barbour appointed Shreve to the post of Superintendent of Western Rivers.⁹

Shreve was a successful steamboat builder, owner, and captain. As such, he was acutely aware of the hazards to navigation on the western rivers, especially the menace of snags. Shreve had designed a steam vessel to remove snags, but it took him a year and a half after becoming Superintendent to convince the Chief Engineer's office that his new "snagboat" was not only desirable but essential to expeditious improvement of navigation on the western rivers. In a letter to Representative Charles A. Wickliffe on November 21, 1827, Shreve predicted that a steam snagboat would cut the cost of snag removal in half; he estimated the price of such a boat at about \$20,000. To impress his superiors with the significance of his innovation, he pointed out that "it will be found impossible to remove many of the most formidable snags and planters by any other means that can be applied." Yet the Government was loathe to part with money. Shreve also bemoaned his inadequate salary, pointing out that "the sufferings and privations attending a confinement on the Mississippi River, at that season of the year when the business must be attended to, needs no comment, as every gentleman from the South and West is well acquainted with the effect of the bilious fever, ague and fever, musketoes [sic], extreme heat, & c." Shreve must have received some incentive to continue braving such uncivilized conditions, for he remained in his position until 1841.¹⁰

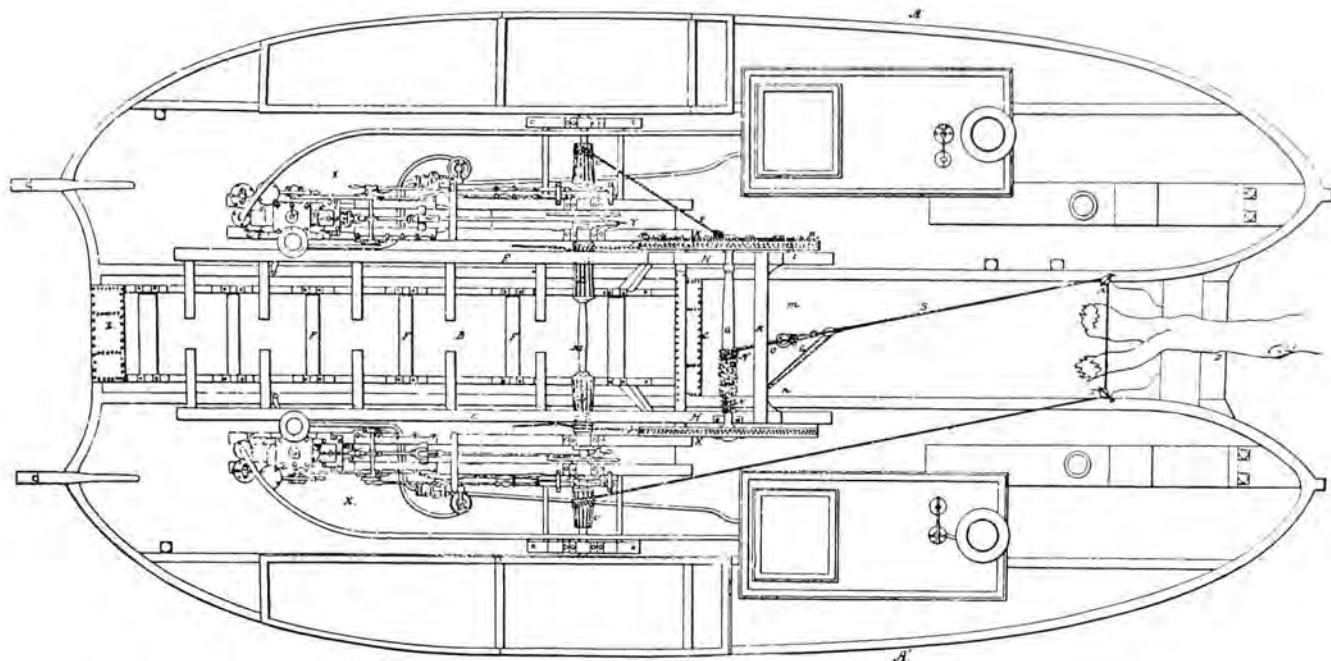


Henry M. Shreve

Henry Shreve



Direct descendant of Shreve's *Heliopolis*, first and most famous of the snagboats. From *Harper's Weekly* (1889).



SHREVE'S SNAG BOAT, PATENT NO. 913, SEPTEMBER 12, 1838

- | | | |
|--|-----------------------------------|---|
| AA': twin hulls | G: main windlass chain | R: gallows frame crossbeam |
| C: inclined bulkhead (iron-sheathed) | LL: inner engine shaft windlasses | UU': outer engine shaft windlasses |
| D: snag beam (iron-sheathed) | M: engine coupling shaft | XX: double steam engines |
| FF: rollers for removal of snag timber | N: main windlass chain | Z: inclined plane for disposal of snag timber |

From Louis Hunter, *Steamboats on the Western Rivers*.

The first steam snagboat, *Heliopolis*, was completed in April 1829, although the Ohio River was so low that the boat could not descend to begin work until August. The boat caused considerable titillation among the rustics who viewed it and elicited skepticism from veteran river pilots. This boat which purportedly would remove the huge snags of the Mississippi was an unlikely-looking sight. Like the machine boat, it had twin hulls, but it was considerably larger and heavier. Because its lifting machinery was geared to the engine, it was far more powerful than the hand-operated machine boats. But its most innovative feature was the heavy, wedge-shaped snag beam sheathed in iron. This beam, which connected the two hulls, was used as a battering ram: the snagboat would plow full tilt into a protruding snag, thus either dislodging it or breaking it off below the river bed. The snag was then lifted onto the boat, cut up, and floated down the river or burned for fuel; heavier sections of the snag, such as the stump and roots, were either dropped into a deep pool or deposited on land. "Uncle Sam's Toothpullers," as the snagboats came to be known, had little difficulty in removing snags weighing as

much as seventy-five tons and buried ten to twenty feet in the riverbed. According to Captain Richard Delafield of the Corps of Engineers, "in 1829, it [the *Heliopolis*] raised a tree 160 feet in length, and 3½ feet in diameter."¹¹

Shreve's success with the snagboat was immediate, but he feared that skeptics in the Chief Engineer's office would not believe his reports, so he took the extraordinary precaution of having his crew attest to the accuracy of his claims as to the number and size of snags removed. If the Chief Engineer and his staff needed convincing, Shreve's 1830 report was designed to achieve that end. "The navigation of the Mississippi river was evidently greatly improved last year," he wrote. "In the year 1828, the losses by snags in that river were not less than one hundred thousand dollars . . . in 1829, the losses were about seventy thousand dollars. In the year 1830, there has not been but one flat boat lost on a snag in that river, that has come within my knowledge, and not a solitary loss by snags of any other description of boats." In fact by 1830 Shreve seems to have cleared the worst obstructions in the Mississippi from St. Louis to New Orleans. In his

1832 report, Shreve claimed that "at the present time, the snags are a minor risk compared with the bursting of boilers, burning boats, and running foul of each other." In 1833, he stated, "I am of the opinion that the Mississippi river is at this time as safe to navigate, excepting in extreme low water, as it will ever be."¹²

Yet his work was not done. Because the Mississippi changed its course frequently, because it had high and rapid waters at certain times of year, and because its western tributaries contributed many snags, the river had to be cleared of snags constantly. Shreve realized almost immediately that removing snags would be a perpetual job unless action was taken to prevent snags from tumbling into the river. The way to insure navigation safe from hazardous snags was "by cutting down all the timber from off the banks of the river, at all places where they are liable to fall in, from three to four hundred feet from the margin of the river; in doing this, the first cause of the obstructions would be removed, and the banks of the river will be preserved." Although Shreve encountered opposition in this plan from rivermen and property owners, he ultimately prosecuted it with considerable success. Shreve had the full support of the Engineers who inspected and supervised his work; in 1832, Captain Delafield estimated that it cost eight dollars to remove each snag, but to prevent snags by felling trees on the banks would cost only one dollar for every fifteen trees. In 1835, Engineer Lieutenant Alexander H. Bowman reckoned the cost at thirteen dollars by snagboat and one dollar per tree on the bank. Both sets of figures indicated clearly that Shreve's plan would, in the long run, be highly advantageous in terms of both economy and safety of navigation.¹³

The Engineers who inspected Shreve's work on the Mississippi were fulsome in their praise. As Lieutenant Bowman summed it up: "In the disposition of his forces; his plan of action; the economy and system observed in the execution of his work; in the perfection of the machinery used, and in the selection of agents, the superintendent has exercised good judgment and has produced most favorable results." Although Shreve would continue in his position as Superintendent until 1841, he had already accom-

plished the most significant part of his work; he had established the system and perfected the machinery which would make the Mississippi safer to navigate. At least in part because of snagging, St. Louis would be a competitive commercial city and would become the steamboat center of the United States before the Civil War. The importance of Shreve and the Corps of Engineers during this crucial period of St. Louis's economic development can hardly be overstated. Steamboat arrivals tell the story: from an occasional steamboat in 1820, arrivals grew to 1721 by 1840, 2879 by 1850, and 3454 by 1860.¹⁴

Yet safe navigation would be significant to St. Louis only so long as the city had a viable harbor. By the 1830s that harbor was endangered; the possibility existed that St. Louis might become a landlocked city. As early as 1823 an observer had noted that the current of the Mississippi River was shifting toward the Illinois side, thus creating a bar in front of St. Louis. He went on to point out, "If this bar continues to increase as it has done for several years past, it will be greatly injurious to the town." Even this early observer realized that the best remedy for the situation would be to force the current back toward the Missouri side, although he considered the feasibility of doing so "extremely doubtful." Yet something had to be done. In 1833 the city leaders decided to take action. They hired John Goodfellow to plow up the sand bars with teams of oxen, thus loosening the sand so that high water would wash it away. The city spent almost three thousand dollars on this project. In return they received no diminution of the sand bars, but they learned the valuable lesson that a more sophisticated means would have to be employed to clear the harbor. As in the case of navigation improvement, only the federal government had the means to undertake such a project. In December 1833, the Mayor of St. Louis wrote to the House Committee on Roads and Canals imploring governmental aid in removal of this hazard to the economic well-being of St. Louis. The committee responded in its report that "a city so interesting should not be suffered to dwindle and decay if the

interposition of legislative agency can prevent it." Besides which, the bar also threatened the landing at the government arsenal just south of St. Louis.¹⁵

After examining the harbor personally, General Charles Gratiot, Chief of the Corps of Engineers, stated that the problem could be overcome by constructing a wing dam from the Illinois shore to the head of Bloody Island (as the northernmost bar was called) and another from the foot of Bloody Island parallel to the Missouri shore, thus forcing the current west of Bloody Island and into the bar forming in front of the harbor. Gratiot discussed the project with Shreve, who agreed that the approach was feasible and who estimated that he could do the work for \$50,000. Gratiot then instructed Shreve to "take the first opportunity his duties would allow to draw up a project of the proposed pier, and commit its construction to some suitable person." Shreve arrived in St. Louis in 1836 and began studying the current and planning its diversion. But Shreve was still in charge of clearing the western rivers, and Gratiot decided that the St. Louis Harbor project was more than Shreve could or should be expected to take on.¹⁶

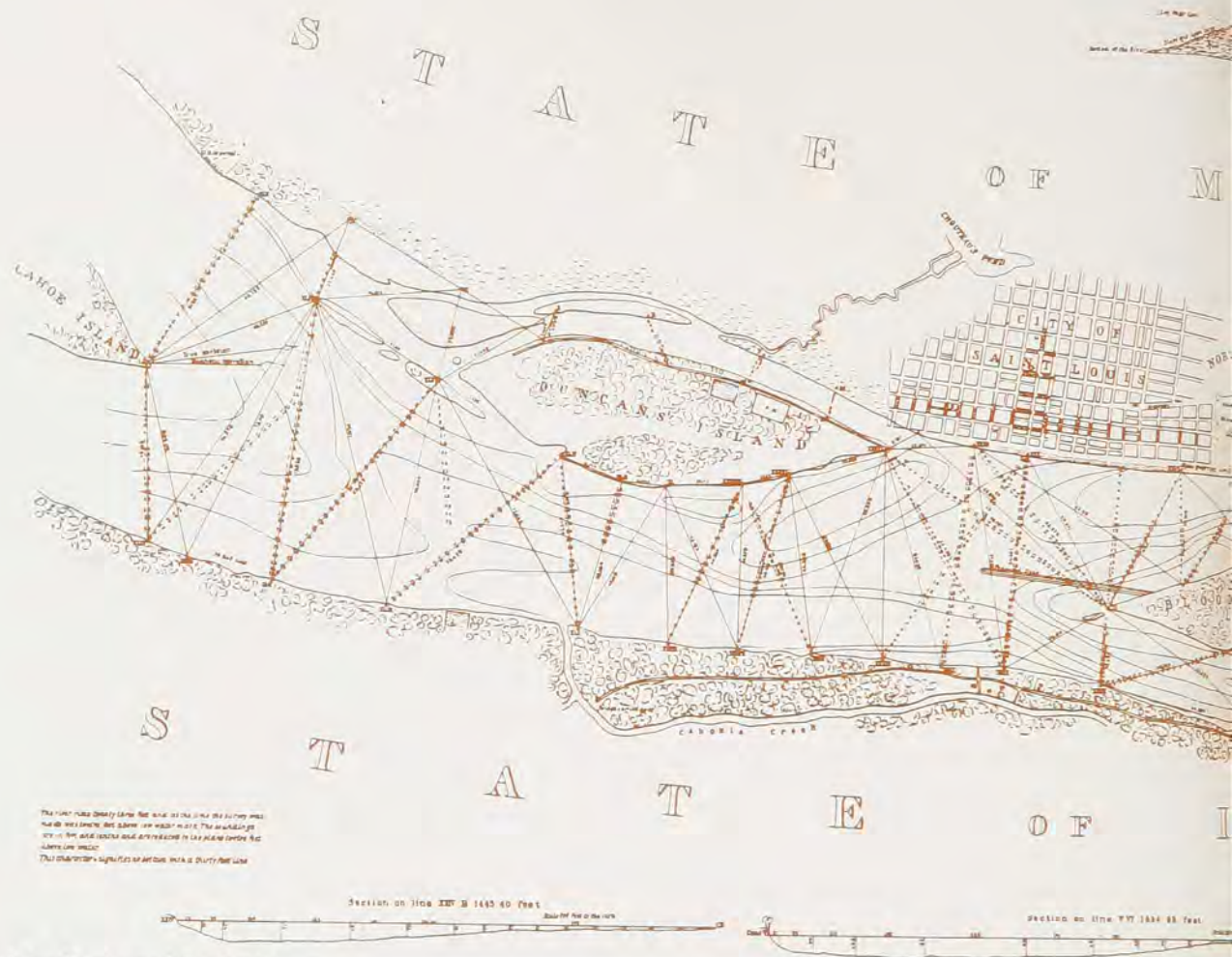


Brigadier General Charles Gratiot
Chief Engineer, 1828-1838.



Robert Edward Lee in the Dress Uniform of a Lieutenant of Engineers. After a painting made about 1831 and credited to Benjamin West, Jr.

Gratiot had in his Washington office a young engineer lieutenant who was anxious to get away from his desk job and into the field. When the lieutenant volunteered to undertake this task, Gratiot agreed, and young Robert E. Lee came to St. Louis to try to restore and preserve the harbor. With him came an even younger second lieutenant, Montgomery C. Meigs, who would survey and chart the Des Moines rapids with an eye to making them navigable. The two men made a remarkable pair: both over six feet tall, Lee erect and handsome, Meigs "with a face just short of handsome," both self-willed and dedicated to their work. While Lee would become a great military leader on the Confederate side in the War Between the States, Meigs (who also constructed the Capitol Dome and Aqueduct in Washington) would become Quartermaster-General for the Union army. That both young men were destined for greatness might not have yet been clear; that both were competent, willing workers was already obvious.¹⁷



Lee's map of the Harbor of St. Louis.

Their first order of business after arriving in St. Louis was to survey the Des Moines rapids on the Upper Mississippi to determine the feasibility of excavating a navigation channel through them. The two men "paddled about in a dugout canoe," with Meigs sketching the topography, handling the level lines, and using the compass in preparation for drawing maps of the rapids. Once they had acquired the necessary information, they returned to St. Louis, where Lee planned a system of wing dams or dikes to save the harbor while Meigs completed his maps.¹⁸

Lee's approach was ultimately a combination of the suggestions of Shreve and Gratiot, utilizing dikes at the head and foot of Bloody Island to force the current into the bar (now known as Duncan's Island) which was threatening the port. Lee estimated the cost at \$158,554, but added that the project was well worth the expenditure to protect the growing commerce of St. Louis. By this time it was winter and too

late to pursue the project, so Lee and Meigs returned home. Meigs would go on to other projects, but Lee would return in the following spring to carry out his assignment.¹⁹

Because Congress had not appropriated enough money to build both dikes, in June 1838 Lee began construction of the dike from the foot of Bloody Island parallel to the Missouri shore, since this course of action promised the most immediate reduction of Duncan's Island. The actual design was somewhat primitive but effective; a series of piles four to five feet apart were driven into the riverbed in two parallel rows. Then the forty-foot area between the rows was filled with brush and rocks and the exterior side of the piles was covered with brush sloping away from the piles at an angle. The brush was weighted with rocks to hold it in place until it was made permanent by silt depositing against it. The effect of this 2500-foot dike was dramatic—by October about 700 feet of



Duncan's Island had washed away. Furthermore, the shoal which had begun forming and had threatened to connect Bloody and Duncan's Islands had deepened seven feet.²⁰

Despite these beneficial results, Lee warned that it would still be necessary to construct a dike from the Illinois shore to the head of Bloody Island. During the winters, another shoal, which extended west of the head of Bloody Island, caught the large chunks of ice floating down the river and formed a natural barricade which forced the river to the east, or Illinois side of the island. Lee believed that the dike from the Illinois shore would cause the current to wear away the offending shoal, but he now felt that his original plan for a dike following a straight line perpendicular to the point of Bloody Island would encounter great stress, especially when the ice floes crashed into it. In order to deflect the ice instead of challenging it head-on, Lee now proposed a longer dike which would

begin much farther upstream and descend to the head of Bloody Island at a sharp angle.²¹

This dike would require a further appropriation from Congress, but on July 9, 1838, Congress adjourned without making any such appropriation. City officials and prominent citizens of St. Louis, not wishing to waste either the favorable conditions of the season or the talents of Lee, advanced \$15,000 of private and city money to support the continuation of the young engineer's work in the expectation that Congress would eventually appropriate the necessary money for construction of the dike. With General Gratiot's approval, Captain Lee began construction of the slanting dike, using the money provided by the citizens of St. Louis. Beginning on the Illinois shore, he drove a double row of piles into the river bed, extending 1300 feet toward Bloody Island. Lee's plan was to intersect the dike at that point with another dike of a single row of piles running from the Illinois

shore to Bloody Island. But by early November the weather intervened and the second part of the project was not completed.²²

During that winter, St. Louis's chance for further appropriations to complete the harbor improvements received a severe jolt when General Charles Gratiot, the Chief Engineer, was dismissed from the Army for refusing to account for certain public funds. Gratiot had been a strong supporter of St. Louis; his successor, Colonel Joseph G. Totten, while a competent engineer and administrator, had no special commitment to the harbor project. This, combined with the dire financial straits of the government following the financial panic of the late 1830s, virtually doomed any hope of obtaining further appropriations for improving the harbor.²³

Nevertheless, Lee had a small amount left in his account, and on August 12, 1839, he commenced construction of the dike to the head of Bloody Island. Lee himself worked beside his men "in the hot, broiling sun." According to biographer Douglas Southall Freeman, "he shared the hard task and common fare and rations furnished to the common laborers." But after only two weeks of work, an Illinois property holder secured an injunction against continuation of construction on the grounds that it threatened to lessen the value of his property by diverting the river. Although Lee considered the suit specious, he was forced to discontinue his efforts. Lee would return in the summer of 1840 to inspect his works and to write a final report, but further appropriations were not forthcoming from Congress; Lee's work in St. Louis was done. He would go on to serve with distinction in the Mexican War, and then brilliantly as commander-in-chief of the Confederate Armies, but St. Louis had been his first independent detail as a supervising engineer. Here he gained valuable experience in problem-solving and decision-making, while he performed invaluable service to the St. Louis area.²⁴

The harbor was still not secure, however. The dikes constructed by Lee needed to be completed, strengthened, repaired, and maintained if the river was to be prevented from returning to the Illinois side of Bloody Island. This work was undertaken by the

city when it became obvious that the federal government was not willing to expend funds to complete the work. One of Lee's civil assistants, Henry Kayser, was named by the city to carry on the work at the city's expense (although Congress had transferred to the city a small amount of money realized from the sale of Lee's equipment). Kayser, a German-born immigrant, became an assistant engineer under Lee in the summer of 1837. After a brief hiatus as cartographer for Joseph Nicollet's expedition seeking the source of the Mississippi in 1838, Kayser returned to the employ of Lee until 1839, when he was appointed to the newly-created post of City Engineer of St. Louis. In that position he was responsible for continuing work on the harbor after the federal government withdrew its support and personnel.²⁵

In the five years after Lee left St. Louis he corresponded with Kayser, providing long-distance guidance. By 1844 it was apparent that the completed portion of Lee's work had been "seriously injured" and that the Mississippi was continuing to eat away at the Illinois shore. Now, more than ever, a wing dam from the Illinois shore to the head of Bloody Island was needed to divert the current. Very few of the piles driven by Lee for the slanting dike extending from the Illinois shore remained, in spite of the city's expenditure of over \$10,000 up to 1844 to repair Lee's dikes. A committee of city leaders memorialized Congress in early 1844, requesting suitable appropriations for the harbor, but in spite of their well-documented arguments for the importance of the harbor, the government did not respond.²⁶

In 1842, the harbor project and improvement of the Mississippi had been transferred to the jurisdiction of the Topographical Bureau as part of a larger plan to place all civil works under that bureau while leaving the Engineer Corps in charge of defense works. In 1843 Topographical Engineer Captain Thomas Jefferson Cram was sent to survey the St. Louis Harbor with an eye to possible improvements, using an appropriation of \$25,000 voted by Congress. Although Cram recommended extensive improvements totalling over \$190,000, the government failed to provide the necessary money. In fact, it appears



— St. Louis Art Museum

View of Cairo, Illinois, 1838 by Antonio Mendelli.

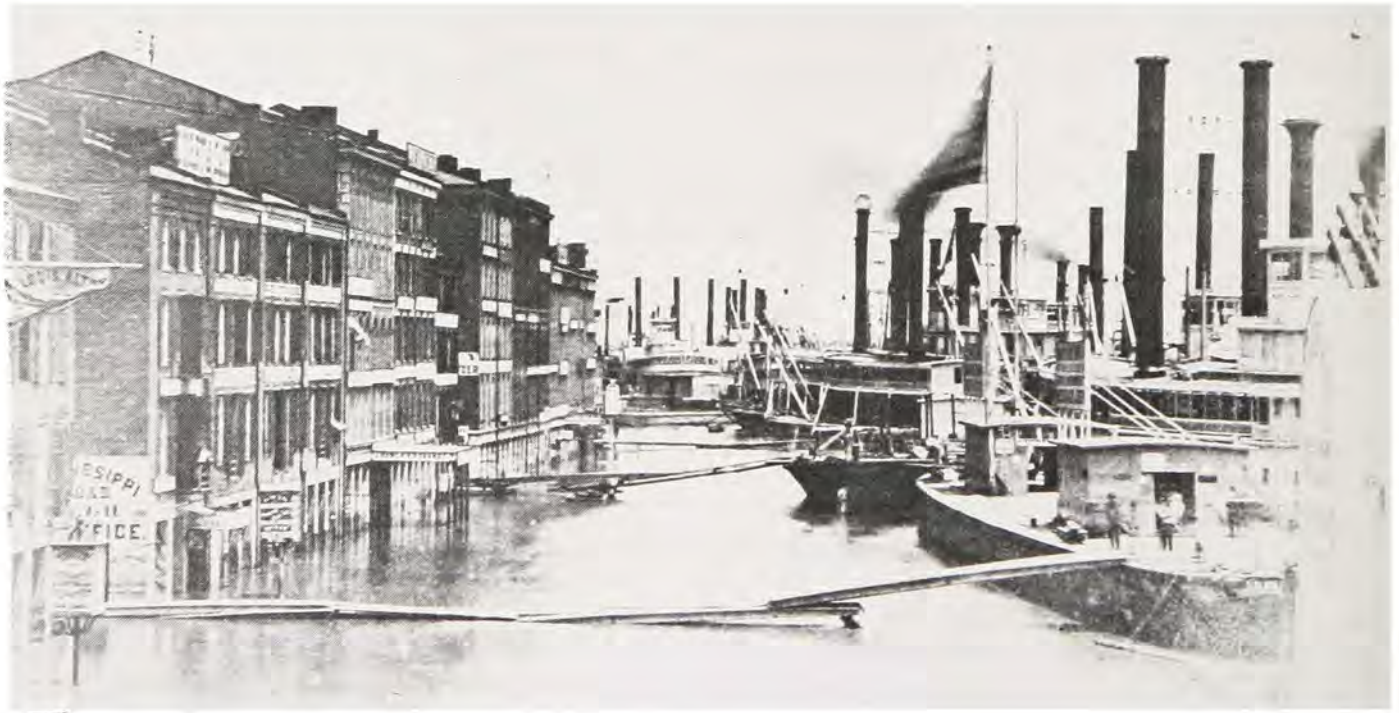
that \$22,709 of the \$25,000 appropriation remained unspent; nor could anyone from St. Louis find out what happened to the money. In the late 1840s the city provided \$25,000 of municipal money for Lieutenant Colonel Stephen H. Long of the Topographical Corps to repair and extend the dike from the Illinois shore to Bloody Island. Long's engineers worked on this project for several years in cooperation with the city.²⁷

The failure of the government to provide money for the St. Louis harbor was part of a larger trend in national politics. The bitter sectional rivalry which was dividing the nation was clearly a factor in the debate over internal improvements. The sections could no more agree on this issue than on anything else. The West, Southwest, and Pennsylvania supported federal expenditures, while New England, New York, and the Old South were opposed. The political parties

split as well, with the Democrats espousing the strict constructionist position while the Whigs supported the contrary view. Although President Andrew Jackson agreed that federally-funded internal improvements were not permitted by the Constitution, he was not consistent in his opposition; in fact, annual expenditures almost doubled during his administration. But after Jackson left office, his Democratic successors staunchly resisted further federal spending for internal improvements. In 1838, the General Survey Act was repealed, reflecting a renewed adherence to the strict constructionist view of internal improvements on the part of the Democrats. Significantly, the only major bills for internal improvements enacted between 1838 and the Civil War were passed in 1842 and 1852 under Whig Presidents. But lack of federal cooperation and financial support were not the only problems to be overcome.²⁸

The river itself posed difficulties; the city's efforts (and, sporadically, Long's) were frequently thwarted by the capricious actions of the Mississippi. In 1844 St. Louis suffered one of the worst floods in its history. The combination of melting winter snows and torrential spring rains poured into the Upper Mississippi and Missouri and their tributaries. By June the crest of the flood reached St. Louis, inundating the Illinois side and covering Front Street in St. Louis. The water rose so high along the St. Louis riverfront that many merchants were forced to move their merchandise to second stories. By June 20 the Mississippi was three to six miles wide, and at some points as much as nine miles. The steamboat *Lightner* was "resting her bow against the front of Henry N. Davis' store at the corner of Front and Morgan Streets." Farther down the river, Kaskaskia was under ten to twenty feet of water. On the 22nd, the situation worsened; the river rose seventeen inches in twenty-

four hours, which, considering the width of the river (now ten to fifteen miles), was an unparalleled rise. The water was four to five feet deep in parts of Second Street; it ultimately reached a height of thirty-eight feet, seven inches above low-water mark. Although the flood had the beneficial effect of washing away part of Duncan's Island, it also seriously damaged the dikes and other improvements in the harbor. In 1851 another flood (only five feet lower than the 1844 flood) again washed away part of the dike erected by the city between Bloody Island and the Illinois shore. Although subsequent floods were nearly as severe in 1854, 1858, and 1863, they did not damage the harbor improvements as seriously as had the two earlier floods. There was an obvious message here: improvement of navigation could not be attempted independently of flood control. This lesson would be a hard one, and it would not be fully ingested for some years to come.²⁹



—Missouri Historical Society

Flood at St. Louis, June 16, 1858.

Steamboat Accidents on the Western Rivers, 1811-1851

Cause of accident	Number	Per cent of total accidents	Average loss (dollars)	Property loss (dollars)	Per cent of total loss
Collision	44	4.5	8,635	379,933	4.5
Fire	166	17.0	10,948	1,817,428	21.0
Explosion	209	21.0	13,302	2,780,118	32.0
Snags, other obstructions, etc.	576	57.5	6,391	3,681,297	42.5

Source: Louis Hunter, *Steamboats on the Western Rivers*

The harbor was ultimately preserved, but the battle to maintain it would be a continuing struggle. The various dikes projected by Lee were finally completed under the direction of Kayser in 1856 at a cost of \$175,000. Lee had presciently forecast in a letter to Kayser on January 15, 1844, "I do not think that there will be any security for the Harbor until the pass East of B. Isd. [sic] is closed and the water confined to the Missouri shore at its low stage at least as far as the city extends." After piecemeal efforts and patchwork over a number of years, Lee's prediction would ultimately come true: the harbor would be secure, Bloody Island would become a part of East St. Louis (and be developed as that city's Third Ward), and Duncan's Island would be washed away completely. Although neither the Corps of Engineers nor the Topographical Corps would finish the project, they had provided the planning and the technical expertise necessary to assure the preservation of the harbor. In years to follow, the Engineers would be called on time and again to protect these gains. The immediate economic impact of harbor preservation was manifested by increases in steamboat arrivals, which doubled between 1840 and 1860, and in population, which grew to almost 200,000 by the lat-

ter date. Without harbor preservation, such growth would have been improbable, if not impossible.³⁰

During the time Lee was engaged in working on the St. Louis Harbor, he was also responsible for the Mississippi from the Ohio River to the Missouri River because of the way the appropriations bill was written. Yet Lee had no snag boats with which to clear the river. At the same time, Shreve's snag boats repeatedly passed through that area in travelling from the Missouri to the Ohio or the lower Mississippi, all of which were still under Shreve's superintendence. Lee wrote to the War Department recommending the transfer to his section of the Mississippi to Shreve. Shreve also suggested that something should be done to clear Lee's section of the river of the dangerous snags in that stretch. That Lee's and Shreve's perceptions of the perilous conditions of the river were correct was clearly illustrated in an 1843 report to the House of Representatives on losses of steamboats on the Mississippi between the Ohio and the Missouri. The figures in the report indicated not only the severity of the problem but also that the problem seemed to be escalating. In 1840, five steamboats valued at \$164,500 were lost in that part of



—Missouri Historical Society

St. Louis Levee, 1850.

the river; in 1841, ten steamboats valued at \$292,800; in 1842, nineteen steamboats valued at \$397,778. A group of St. Louis citizens labelled it "the most dangerous portion of the whole river."³¹

In the years 1838-1842, western river improvement had been sharply curtailed. The financial condition of the government was such during the recession after 1837 that Congress was reluctant to appropriate money for public works. Finally, however, between 1842 and 1845 Congress appropriated a total of \$430,000 for western rivers improvement. Also in 1842, superintendence of western river improvement was transferred to the Corps of Topographical Engineers, and, in early 1843, Lieutenant Colonel Stephen H. Long was assigned to superintend that work. During the years when the government provided money, Long followed the same policies as Shreve, removing snags with steam snagboats (over 58,000 in three years) and felling trees on the banks (almost 75,000 during the same period). But in 1846 Congress failed to pass a rivers and harbors bill (in large part because

of a preoccupation with the Mexican War) and the flurry of activity on the western rivers ground to a halt.³²

In the succeeding six years, either Congress or the President or both opposed further appropriations. Not until 1852 did Congress again pass and the President sign a river and harbor bill, the \$2,000,000 appropriation alluded to earlier. Because of the scope and number of civil works provided for in the bill, in 1852 the Corps of Engineers was once again given responsibility for some civil works projects. The Mississippi, however, remained under the jurisdiction of the Topographical Corps. For a time, funds were sufficient to improve navigation on the middle Mississippi, but by 1855 funds were exhausted and improvements again were discontinued.

Nevertheless, in the years following the Civil War, St. Louis would continue to be an important center for river commerce. Appropriations for river improvements shot upward dramatically in the post-war years, and the Corps of Engineers would play an

increasingly significant role in the St. Louis area economy. As the scope of the Engineers' work enlarged, it became desirable to establish a permanent office in St. Louis. As St. Louis continued to grow, the Corps of Engineers would contribute to that growth and would become inextricably intertwined in the commercial expansion and economic security of the area. No further substantive Federal work on the western rivers would be undertaken until after the Civil War.³³

It was ironic that the government provided such faltering and uneven support for western rivers improvement in the 1840s and 1850s, for it was in that period that steamboating reached its zenith; after the Civil War it would lose its leadership position in transportation to the railroads. Inevitably, with the combination of infrequent government efforts to clear the

rivers and increased steamboat traffic plying the rivers, accidents increased. Such accidents were doubly tragic because by the early 1850s passengers were the most numerous and important cargoes on steamboats. The stretch between the Missouri and the Ohio remained one of the most dangerous parts of the Mississippi, and one of the most heavily travelled. By 1853 St. Louis had 529 more steamboat arrivals than New Orleans; "the waterfront was lined with steamboats, two or three deep." Over a million passengers arrived at or departed from the St. Louis riverfront in 1855.³⁴

The government not only failed to appropriate money to maintain the rivers, it actually sold five snag boats in 1855, revealing a monumental disinterest in the problems of western navigation. James B. Eads and William Nelson bought the boats, in part because the vessels could be used for the partners'



—Missouri Historical Society

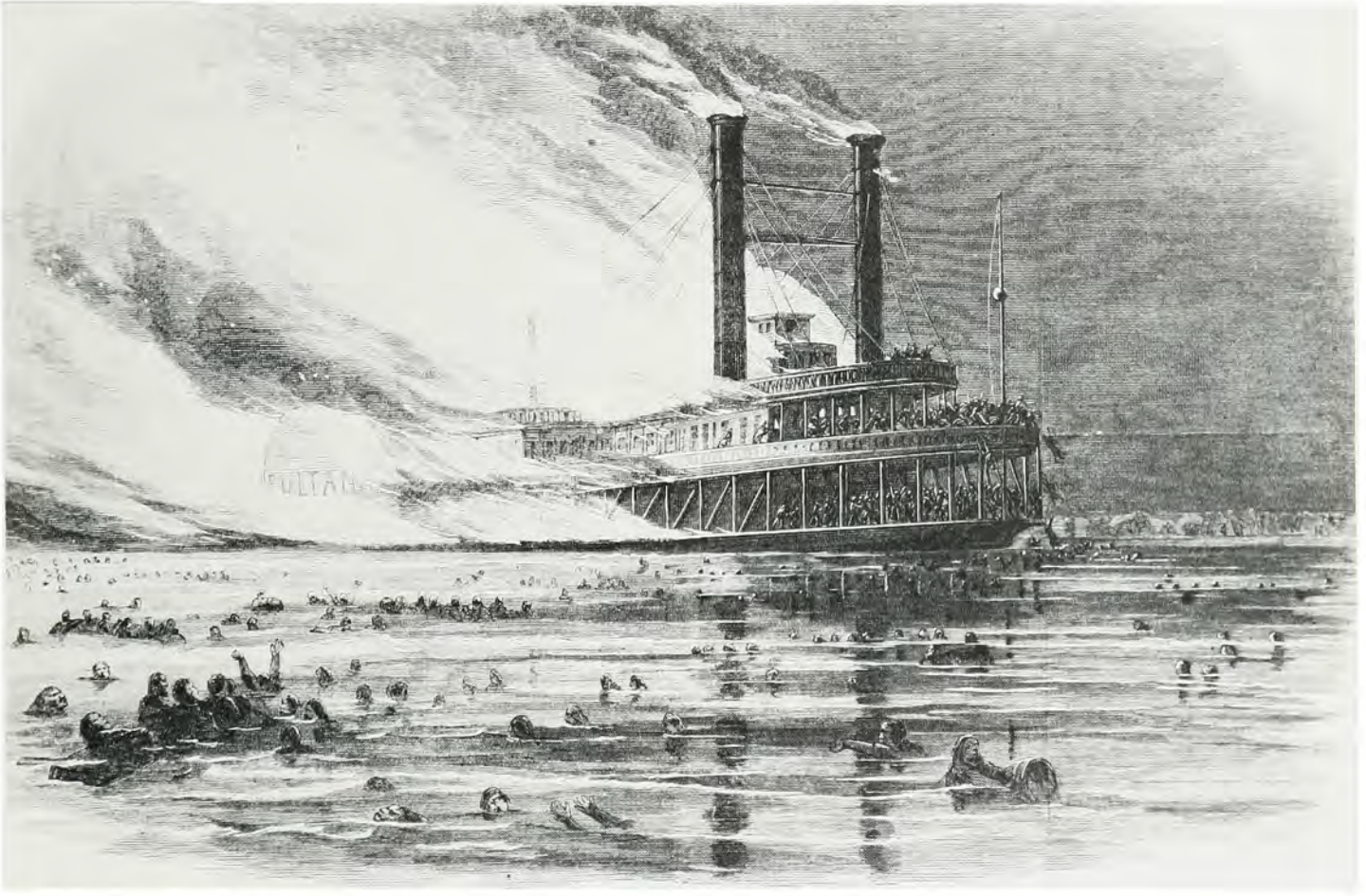
St. Louis, 1853 by Frederick Piercy.
Note snag in left foreground and stone wing dike in right foreground.

salvage operations and in part because Eads was aghast that snagging might be discontinued on the western rivers. Eads was concerned about river safety, and he was convinced that snagging was essential to safe navigation. Since the federal government was obviously not going to provide this service, Eads set out to do it himself. In 1856 he went to Washington to present a bill in which he offered to clear the western rivers for a modest annual sum. The bill passed the House of Representatives but was defeated in the Senate, primarily due to the opposition of Jefferson Davis (who felt that Eads did not have the proper qualifications to be entrusted with such an undertaking). Eads was not easily discouraged, however, and when he returned from Washington he formed a private snagging company, the Western River Improvement Company, which was underwritten by more than fifty marine insurance companies. In snagging, as in the case of the St. Louis Harbor, local enterprise had to fill the vacuum created by the federal government's abdication of responsibility for internal improvements.

The 1850s was the golden age of steamboating in St. Louis. By 1860 the annual river trade of St. Louis was valued at \$200,000,000. Although appropriations had been sporadic since 1839, certain projects outside the St. Louis area had been pushed forward by the Engineers which had contributed greatly to the city's economic growth: the improvement of the rapids at Des Moines and Rock Island, the clearing of the mouths of the Mississippi, and the construction of the Illinois and Michigan Canal on the Illinois River linking the Great Lakes to the Mississippi. Unfortunately for St. Louis's commercial ambitions, the 1850s also was a period of tremendous growth of railroads, a growth in which St. Louis participated to only a limited extent. Business leaders in St. Louis,

according to Wyatt Belcher, "clung to the old method of river transportation even after it was apparent that Chicago was using the railroads to divert commerce from the Upper Mississippi Valley at a rapid rate." Chicago's growth was accelerated by the Civil War, which at the same time dealt a severe blow to St. Louis—the Lower Mississippi Valley was closed to trade after secession. To exacerbate the already bad situation, "the entire river commerce of St. Louis was placed under military control and surveillance" on December 10, 1861. Throughout the remainder of the war, trade restrictions imposed by the federal government would hamper St. Louis's commerce and thus work to the advantage of Chicago. The process by which Chicago would assume its position as foremost city of the Midwest was irrevocably underway by the end of the Civil War.³⁵

Although the Corps of Engineers had been conceived in wartime, during the first half of the nineteenth century it had begun to prove its worth in civil works. The remarkable growth of river commerce on the Mississippi was due in part to the efforts of the Corps of Engineers in clearing the river, and the prosperity of the St. Louis harbor was in part the result of Corps-sponsored harbor preservation. But despite the efforts of men like Shreve and Lee, truly effective action by the Engineers would have to await the development of a rational and consistent federal policy. Such a policy did not exist prior to the Civil War. Unfortunately for St. Louis, it was during those years of the steamboat boom that federal aid was needed most. By the time internal improvements on the rivers had been systematized, railroads were gaining prominence at the expense of river traffic and St. Louis was losing its position of economic leadership in the Midwest.



—Missouri Historical Society

Explosion of the Steamer Sultana April 28, 1865, from Harper's Weekly, May 20, 1865. Such disasters continued to occur throughout the 19th century.

Footnotes Chapter 2

1. See Elting E. Morison, *From Know-how to Nowhere* (New York, 1975); Frank E. Snyder and Brian H. Guss, *The District: A History of the Philadelphia District, U.S. Army Corps of Engineers, 1866-1971* (Philadelphia, 1974), 1-4; Elizabeth Kite, *Brigadier-General Louis Lebeque Duportail, Commandant of Engineers in the Continental Army, 1777-1783* (Baltimore, 1933).
2. See the Engineer School, *History and Traditions of the Corps of Engineers* (Fort Belvoir, Va., 1953); Russell F. Weigley, *History of the United States Army* (London, 1967), 105-6, 164, 272; Snyder and Guss, *The District*, 1-2.
3. Henry C. Jewett, "History of the Corps of Engineers to 1915," *The Military Engineer*, 38 (August 1946), 340-46; Snyder and Guss, *The District*, 2; Weigley, *U.S. Army*, 166-67; Richard A. Wood, *Stephen Harriman Long: Engineer, Explorer, Inventor* (Glendale, Calif., 1966), 143-44; W. Stull Holt, *The Office of the Chief of Engineers of the Army: Its Non-military History, Activities, and Organization* (Baltimore, 1903), 3; Henry P. Beers, "A History of the U.S. Topographical Engineers, 1813-1863," *The Military Engineer*, 34 (1942), 289-91; Forest A. Hill, *Roads, Rails, and Waterways: The Army Engineers and Early Transportation* (Norman, 1957), 174-77.
4. George Rogers Taylor, *The Transportation Revolution, 1815-1860* (New York, 1951), 56, 65-66; John H. Krenkel, *Illinois Internal Improvements, 1818-1848* (Cedar Rapids, Ia., 1958), 10-11; Louis C. Hunter, *Steamboats on the Western Rivers* (Cambridge, Mass., 1949), 181.
5. Florence Dorsey, *Master of the Mississippi* (Boston, 1941), 141-44; U.S. Congress, House, *Message Concerning the Ohio and Mississippi Rivers*, H. Doc. 17-35, 17th Congress, 2nd Session, 21, 1823; U.S. Congress, House, *Report on the Act to Improve the Navigation of the Ohio and Mississippi Rivers*, H. Rep. 18-75, 18th Congress, 1st Session, 3, 1824; Taylor, *Transportation Revolution*, 65-66.
6. Marcus Cunliffe, *The Nation Takes Shape, 1789-1837* (Chicago, 1959), 102-113, 141; George Dangerfield, *The Awakening of American Nationalism, 1815-1828* (New York, 1965), 196-201; John Furman Wall, "The Civil Works of the United States Army Corps of Engineers: Program Modernization" (unpublished Ph.D. dissertation, Cornell University, 1973), A9-A22; Clement Eaton, *Henry Clay and the Art of American Politics* (Boston, 1957), 34-37, 43, 46; George R. Taylor, *The Transportation Revolution, 1815-1860* (New York, 1951), 18-22.
7. Dangerfield, *Awakening of American Nationalism*, 196-201.
8. H. Doc. 17-35, 21; H. Rep. 18-75, 3; Hill, *Roads, Rails, and Waterways*, 163; Weigley, *U.S. Army*, 166; 4 *Statutes at Large*, 33.
9. Dorsey, *Master of the Mississippi*, 142-60; Hunter, *Steamboats on Western Rivers*, 181-215; "Henry Miller Shreve," *Dictionary of American Biography*, XVII, 133-34; U.S. Congress, House, *Letter Relative to Navigation of the Mississippi River*, H. Doc. 20-11, 20th Congress, 1st Session, 4, 1827; U.S. Congress, House, *Letter Relative to Improvement of the Mississippi and Ohio Rivers*, H. Doc. 21-9, 21st Congress, 2nd Session, 9, 1830.
10. *Ibid.*
11. *Ibid.*
12. H. Doc. 21-9, 2; *Annual Report of the Chief of Engineers, 1832*, 114-16; *Annual Report, 1833*, 129. In 1831, for example, Shreve's snagboats removed 2265 snags from the Mississippi, *Annual Report, 1831*, 91.
13. H. Doc. 20-11, 4; U.S. Congress, House, *Message on Improvement of the Navigation of the Ohio and Mississippi Rivers*, H. Doc. 22-66, 22nd Congress, 2nd Session, 4, 1833; *Annual Report, 1835*, 178.
14. *Annual Report, 1834*, 163; Hunter, *Steamboats on Western Rivers*, 43; Taylor, *Transportation Revolution*, 165-66.
15. Lewis C. Beck, "St. Louis," in John Francis McDermott, ed., *Early Histories of St. Louis* (St. Louis, 1952), 86-87; John Thomas Scharf, *History of Saint Louis City and County* (Philadelphia, 1883), 1054; U.S. Congress, Senate, *Report on Bar Opposite St. Louis*, S. Doc. 23-300, 23rd Congress, 1st Session, 2, 1834; U.S. Congress, House, *Harbor at St. Louis*, H. Rep. 23-14, 23rd Congress, 2nd Session, 1-2, 1834.
16. H. Rep. 23-14, 2-5, 10; Dorsey, *Master of the Mississippi*, 190-91; John F. Darby, *Personal Recollections* (St. Louis, 1880), 226-27. Bloody Island gained its name as a result of the numerous duels fought there. Because it was situated in the middle of the Mississippi, duelists were not subject to prosecution in either Missouri or Illinois.
17. Douglas Southall Freeman, *R. E. Lee: A Biography*, I (New York, 1935), 138-40; Russell F. Weigley, *Quartermaster General of the Union Army. A Biography of M. C. Meigs* (New York, 1959), 24-33.
18. Weigley, *Quartermaster General*, 33-34; Freeman, *R. E. Lee*, I, 140-45.
19. U.S. Congress, House, *Harbor of St. Louis*, H. Doc. 25-298, 25th Congress, 2nd Session, 1-7, 1838; Weigley, *Quartermaster General*, 33-34; Freeman, *R. E. Lee*, I, 145-47. The terms "wing dam," "pier," and "dike" were used interchangeably in contemporary engineer reports. For a detailed account of harbor improvements to 1870, see *Annual Report, 1871*, 321-27.
20. H. Doc. 25-298, 3-4; *Annual Report, 1838*, 236-37; Freeman, *R. E. Lee*, I, 147-52.
21. *Annual Report, 1838*, 236-37; Freeman, *R. E. Lee*, I, 152-54.
22. Lee was commissioned a captain as of August 7, 1838. *Annual Report, 1839*, 199-202; Freeman, *R. E. Lee*, I, 154-58.
23. Freeman, *R. E. Lee*, I, 156-58.
24. *Annual Report, 1840*, 135-36; Freeman, *R. E. Lee*, I, 170-83; Darby, *Personal Recollections*, 230.
25. Freeman, *R. E. Lee*, I, 182-83; *Annual Report, 1841*, 108; Stella Drumm, "Letters of Robert E. Lee to Henry Kayser, 1838-1846," *Glimpses of the Past*, 3 (January-February, 1936), 1-43.
26. *Annual Report, 1842*, 277-78; *Annual Report, 1843*, 134-35; U.S. Congress, House, *Harbor of St. Louis*, H. Doc. 28-203, 28th Congress, 1st Session, 10-13, 1844; U.S. Congress, House, *Memorial Relative to Harbor of St. Louis*, S. Doc. 28-185, 28th Congress, 1st Session, 1-45, 1844; Drumm, "Letters of Robert E. Lee," 32.
27. Hill, *Roads, Rails and Waterways*, 181-83; William Hyde and Howard L. Conard, eds., *Encyclopedia of the History of St. Louis*, II, (New York, 1899), 984; Wood, Stephen Long, 204, 211; *Annual Report, 1844*, 272; *Annual Report, 1845*, 372; Scharf, *History of St. Louis*, 1056; *Annual Report, 1851*, 429-30.
28. Hill, *Roads, Rails, and Waterways*, 184-92; U.S. Congress, Senate, *Report on River and Harbor Improvements*, S. Doc.

- 29-451, 29th Congress, 1st Session, 9. 1846; *Annual Report, 1846*, 140-41; *Annual Report, 1847*, 670-78; *Annual Report, 1849*, 335-37; *Annual Report, 1851*, 428-30; *Annual Report, 1852*, 221-23; Taylor, *Transportation Revolution*, 18-22; Dangerfield, *Awakening of American Nationalism*, 201; Wall, "Civil Works," A40-A45.
29. Scharf, *History of St. Louis*, 1063-66; S. Doc. 29-1, 370-71.
30. Carl Baldwin, "River Diversion War: St. Louis vs. Illinois," *St. Louis Post-Dispatch*, March 5, 1975, 3F; Taylor, *Transportation Revolution*, 165-66.
31. H. Doc. 26-1, 122-30; U.S. Congress. Senate. *Memorial Relative to Harbor of St. Louis*. S. Doc. 28-185, 28th Congress, 1st Session, 22-23. 1844; U.S. Congress. House. *Statement of Calvin Case, as to the Facts in Relation to the Loss of Boats on the Mississippi*. H. Rep. 27-178, 27th Congress, 3rd session, 1-6. 1842; U. S. Congress. Senate. *Supplement to Annual Report*. S. Doc. 125, 26th Congress, 1st Session, 3-5. 1840.
32. *Annual Report, 1842*, 277-78; *Annual Report, 1843*, 130; Drumm, "Letters of Robert E. Lee," 28; Wood, *Stephen Long*, 203-210; *Annual Report, 1845*, 347.
33. *Annual Report, 1846*, 140; *Annual Report, 1849*, 336; *Annual Report, 1851*, 428; *Annual Report, 1852*, 222; Hill, *Roads, Rails, and Waterways*, 186-92; *Annual Report, 1853*, 19-22; *Annual Report, 1856*, 366; *Annual Report, 1857*, 290; *Annual Report, 1858*, 1096; *Annual Report, 1859*, 696-97; *Annual Report, 1860*, 298-99; U.S. Congress. House. *Report on Internal Improvements*. H. Doc. 37-9, 37th Congress, 1st Session, 23. 1861; 10 *Statutes at Large*, 56; Florence Dorsey, *Road to the Sea: The Story of James B. Eads and the Mississippi River* (New York, 1947), 42-48.
34. Taylor, *Transportation Revolution*, 166; William J. Peterson, *Steamboating on the Upper Mississippi* (Iowa City, Ia., 1968), 373; Dorsey, *Master of Mississippi*, 256-58.
35. Wyatt W. Belcher, *The Economic Rivalry Between St. Louis and Chicago, 1850-1880* (New York, 1947), 15, 47, 140; Isaac Lipincott, "A History of River Improvement," *Journal of Political Economy*, 22 (1914), 642. For additional information on state and local economic development, see James Neal Primm, *Economic Policy in the Development of a Western State: Missouri, 1820-1860* (Cambridge, Mass., 1954) and Halvor Gordon Melom, "The Economic Development of St. Louis, 1803-1846," (unpublished M.A. thesis, University of Missouri, 1947).



The Eads Bridge under Construction.

Regularizing a River: Engineers on the Middle Mississippi

River commerce on the upper and middle Mississippi declined in importance in the years after the Civil War. Wartime conditions had assured the rapid ascendancy of the railroad over the steamboat, although the war had merely hastened the already inevitable conclusion. One result was the loss of the Upper Mississippi Valley trade by St. Louis to Chicago; the commerce in that area began moving on an east-west axis rather than north-south. St. Louis had counted too heavily on her traditional strength as a leader in river commerce and had not adapted quickly enough to altered economic conditions created by the development of the railroads.¹

Not only did the railroads steal the traditional steamboat markets in the hinterlands, but they also invaded the very stronghold of river commerce, St. Louis. According to Frank Dixon, "in 1869 it was said that grain could be moved by rail from St. Louis to the north Atlantic seaboard for a much smaller sum than the usual rate for carrying it from St. Louis to New Orleans." This difference in cost resulted in part from preferential rate structures erected by the railroads in locales where water competition existed and in part because railroads were increasing their speed, efficiency, and reliability while steamboats were not. Rivermen had no choice; they had to respond to the challenge of the railroads or perish. Their response took two forms—they sought increased governmental aid to navigation to insure greater speed and reliability of water transport and they introduced the barge system to guarantee greater efficiency and economy in river commerce.²





—Missouri Historical Society

The St. Louis Levee, 1867, from a stereo by Boehl and Roenig.

The barge was an important innovation because the shallow western rivers required a vessel which carried most of its load above the water line. Furthermore, a single towboat could move a large number of barges (a five-acre platform of barges, lashed together, was not uncommon in later years); this system also added a railroad-like flexibility to river commerce—a barge could be added or dropped at points along the way without great delay. The barge was more economical than the steamboat (as much as 100,000 bushels of grain could be shipped at one time) and it was also safer because of its shallow draft.³

But, wrote historian Louis Hunter, the barge system “failed to restore river commerce to anything approaching its former importance in the economy of the West.” Although rivermen had, in the immediate postwar years, held high hopes for the barge as the salvation of river commerce, by the end of the

century the decline of the river’s significance was obvious. “In 1890 the total rail business of St. Louis was twelve times the river traffic at this point, in 1900 thirty-two times, and by 1906 one hundred times.” While the barge system represented an improvement over steamboats, railroads were making even greater strides in providing rapid and reliable transportation. The only area in which barges were competitive with the railroads was in the movement of bulk items such as grain and timber. By the end of the century, even these commodities had been diverted by the railroads.⁴

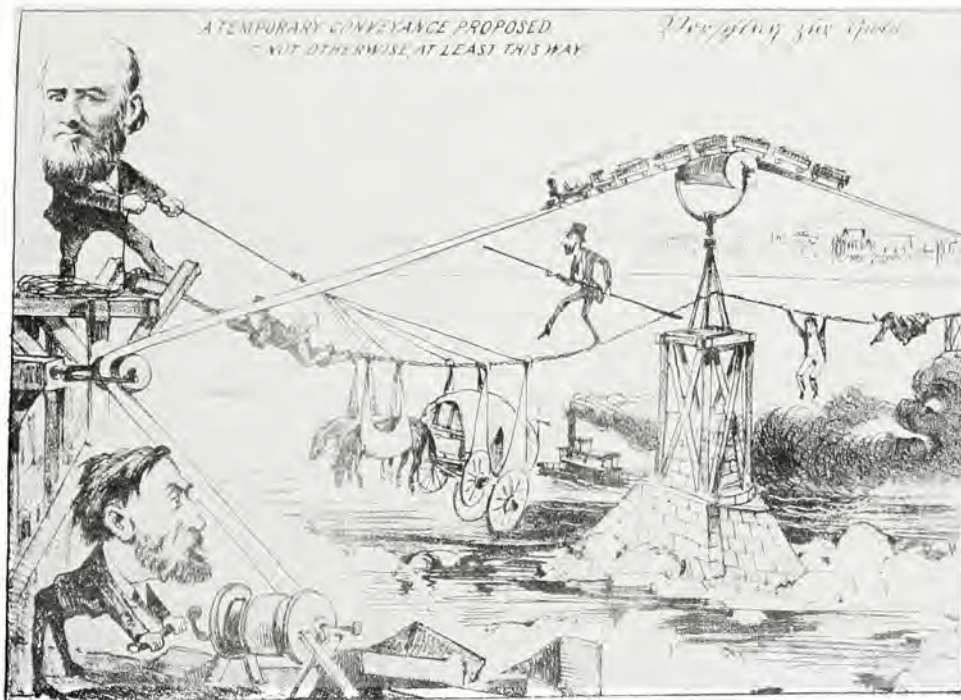
The river interests obviously needed some form of outside intervention to maintain any markets at all in the face of the railroads’ challenge. They turned to the federal government for help. Their efforts took two directions, one positive and one negative. On the positive side, rivermen successfully pressed the government for large expenditures to improve the

navigability of the Mississippi and its tributaries; on the negative side, river interests sought to thwart the erection of the Eads Bridge across the Mississippi at St. Louis. They feared, correctly, that this link between eastern and western railroads would further vitiate river traffic.

In 1866 the St. Louis and Illinois Bridge Company had been formed to construct a bridge at St. Louis. James Buchanan Eads, a noted steamboat captain and shipbuilder, was chosen chief engineer of the bridge company, even though he had never before constructed a bridge (nor would he construct another one after this). Eads' bridge was revolutionary in both design and method of construction. His blueprint called for a bridge of three spans (502 feet, 520 feet, 502 feet) supported by four piers. These spans would be the longest ever constructed to that time. He also pioneered the use of tubular chord members, of alloy

steel in bridge building, and of cantilevering instead of false works in erecting the spans. He was the first American to utilize pneumatic caissons in underwater construction; furthermore, he sank the caissons much deeper than had any of his European predecessors. Eads knew he had to take the bridge abutments to rock bottom to assure their permanency, and rock bottom was over 100 feet below the surface.⁵

By 1873 the bridge was nearing completion, and even the most skeptical became convinced that Eads' fantastic scheme was coming to fruition. It was at this time that the St. Louis rivermen began to realize the potential impact of the bridge on their trade. They had to stop the bridge. Fortunately, from their standpoint, they had what they considered a legitimate objection to Eads' structure (albeit one they should have registered at the outset instead of shortly before the bridge's completion)—the spans were only



—Missouri Historical Society

Contemporary cartoon commenting on Eads' difficulties in completing the Illinois and St. Louis Bridge. From the St. Louis humor magazine *Puck* (Vol. 1, no. 43, 1872?).

fifty-five feet above the river at high water. Some steamboats had smokestacks as high as one hundred feet. Clearly the bridge was a menace to navigation, they reasoned, and since the federal government had the duty of maintaining navigability on interstate waterways (*Gilman v. Philadelphia*, 1866), they conveyed their feelings to Secretary of War William Belknap in a formal protest. In response, the Secretary appointed a Board of Engineers "to examine the construction of the St. Louis and Illinois Bridge across the Mississippi River at St. Louis and report whether the bridge will prove a serious obstruction to the navigation of said river, and if so, in what manner its construction can be modified." The board was composed of five Engineers: Major Gouverneur K. Warren, Chairman, Major Godfrey Weitzel, Major William E. Merrill, Major Charles R. Suter, and Colonel James H. Simpson, St. Louis District Engineer.

The Board members, all of them favorably disposed toward navigation interests rather than railroad interests, agreed that the bridge threatened to cut river commerce in half at St. Louis. They recommended that an 800-foot canal be built around the east abutment of the bridge at the expense of the bridge company. Such a requirement would have bankrupted the bridge company; only an eleventh-hour appeal by Eads to President Ulysses S. Grant prevented the enactment of this recommendation. The bridge was completed, and it fulfilled the worst expectations of the rivermen; with the bridge's opening to rail traffic on July 4, 1874, the railroads had taken another giant stride toward complete dominance of internal commercial transportation.⁶

Although the river interests had failed to halt the spread of the railroads, they continued to lobby vigorously for improvement of their own competitive position by seeking federal expenditures for improve-



The completed Eads Bridge.



—Missouri Historical Society



A typical bill of lading for a steamboat shipment.

Average Annual Steamboat Arrivals at St. Louis, 1845-1895

Period	From the Lower Mississippi	From the Upper Mississippi	From the Missouri	From the Illinois	From the Ohio	From other ports	Total	Index of arrivals	Index of cargo received and shipped
1845-1848	398	656	286	518	421	335	2,716	110	...
1849-1852	311	696	341	741	469	344	3,100	114	...
1866-1870	712	947	335	370	252	...	2,675	98	...
1871-1875	805	922	139	268	177	...	2,354	87	100
1876-1880	863	909	141	262	191	...	2,365	87	99
1881-1885	786	894	104	188	143	...	2,226	82	92
1886-1890	767	909	145	160	152	...	2,114	78	82
1891-1895	864	796	97	147	105	...	2,008	74	62

Source: Louis Hunter, *Steamboats on the Western Rivers*.

It was this large influx of federal money into river and harbor improvement that caused the eventual formation of a number of new Engineer Districts. It became not only desirable but necessary to have Engineers stationed at the localities where improvements were proposed, to carry out surveys, determine priorities, supervise construction, and lend continuity to planning. The St. Louis District's progenitor was the Office of Western River Improvements. After 1865 that office had continued its pre-war mission of removing obstructions to navigation, particularly snags, under the command of Colonel J.N. Macomb. On July 12, 1870, Colonel Macomb was relieved by Lieutenant Colonel William F. Reynolds, who supervised the transfer of the office from Cincinnati to St. Louis. Reynolds had as assistants two other Engineers, Captain Charles R. Suter and Captain Charles J. Allen.

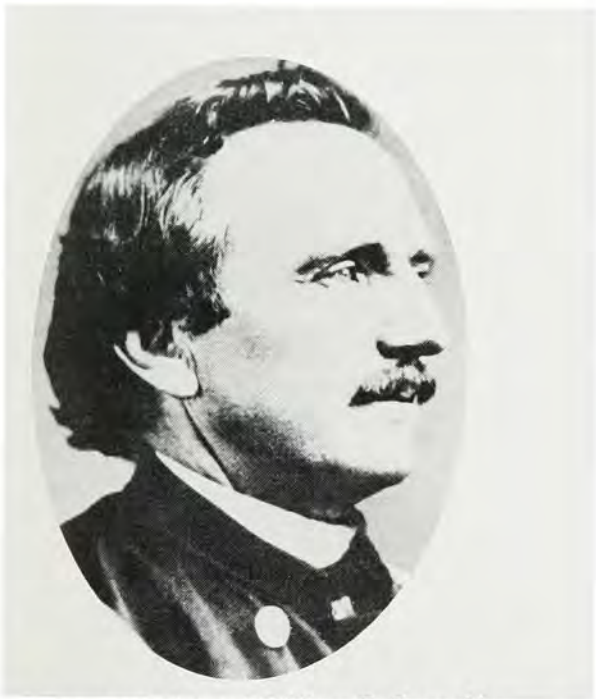
Back in 1859, the then-Captain Reynolds had gained national prominence by leading the first expedition dispatched by the Topographical Bureau to explore the area around the Continental Divide that

was to become Yellowstone National Park. Now, however, the Corps of Engineers had as a primary mission facilitating transportation and communication in inhabited areas, and Reynolds was assigned to a more sedentary, if no less challenging, position as the head of Western River Improvements.⁸

Even though Reynolds' primary function was river clearance, he was also instructed to undertake certain projects which would be completed by the soon-to-be formed St. Louis District. Included among his assignments between 1870 and 1873 were surveys of the St. Louis and Alton Harbors and an examination of the banks opposite the mouth of the Missouri River. Although the first actual construction toward a comprehensive improvement of the river system within the St. Louis District was not begun until 1872, the surveys and examinations of Reynolds, Suter, and Allen date back to 1870. Thus, in a sense, the work of the District begins in 1870, although it is under the aegis of the Office of Western River Improvements. The duties of the St. Louis District Engineer Office and the Office of Western River Improvements were



Government snagboat *Macomb*, built in 1874.



Lieutenant Colonel William F. Reynolds
Engineer in charge of the Office of Western River Improve-
ments, July 12, 1870-January 1, 1873.

not divided into distinct entities until April 7, 1873.⁹

In addition to operating snagboats to clear the rivers, Raynolds' office had been charged by the River and Harbor Act of 1870 with examining and surveying St. Louis Harbor, Alton Harbor, and the banks opposite the mouth of the Missouri River, as well as a number of lesser projects. Improvement of St. Louis Harbor dated back to the time when Robert E. Lee was stationed in St. Louis. Yet the Harbor still posed problems for city merchants and rivermen, despite expenditures in excess of \$900,000 on the Harbor up to 1868 (\$850,000 of the money had been supplied by the city). The federal government assumed the financial burden for the needed improvements beginning in 1872; the River and Harbor Act of that year provided \$100,000 for improvement of the Mississippi between the mouth of the Missouri and the mouth of the Meramec. A Board of Engineers was convened in 1872 to recommend a course of action for expending the appropriation. Their



—Missouri Historical Society

St. Louis in 1876, from *Harper's Weekly* (1876).

report called for the protection of Sawyer's Bend and the raising and extension of three existing dikes protruding from the Illinois shore.¹⁰

The goal of these improvements was to guarantee a regularized channel through the St. Louis Harbor, sufficiently narrow and deep to accommodate the large amount of river traffic docking in St. Louis throughout most of the year. Sawyer's Bend was so named because of the large number of saw logs, stumps, and uprooted trees that came to rest on and in sand bars in that locality. The bend, on the Missouri side of the river, extended from the foot of Grand Avenue (known as Bissell's Point) northward toward the Chain of Rocks. The main channel of the Missis-

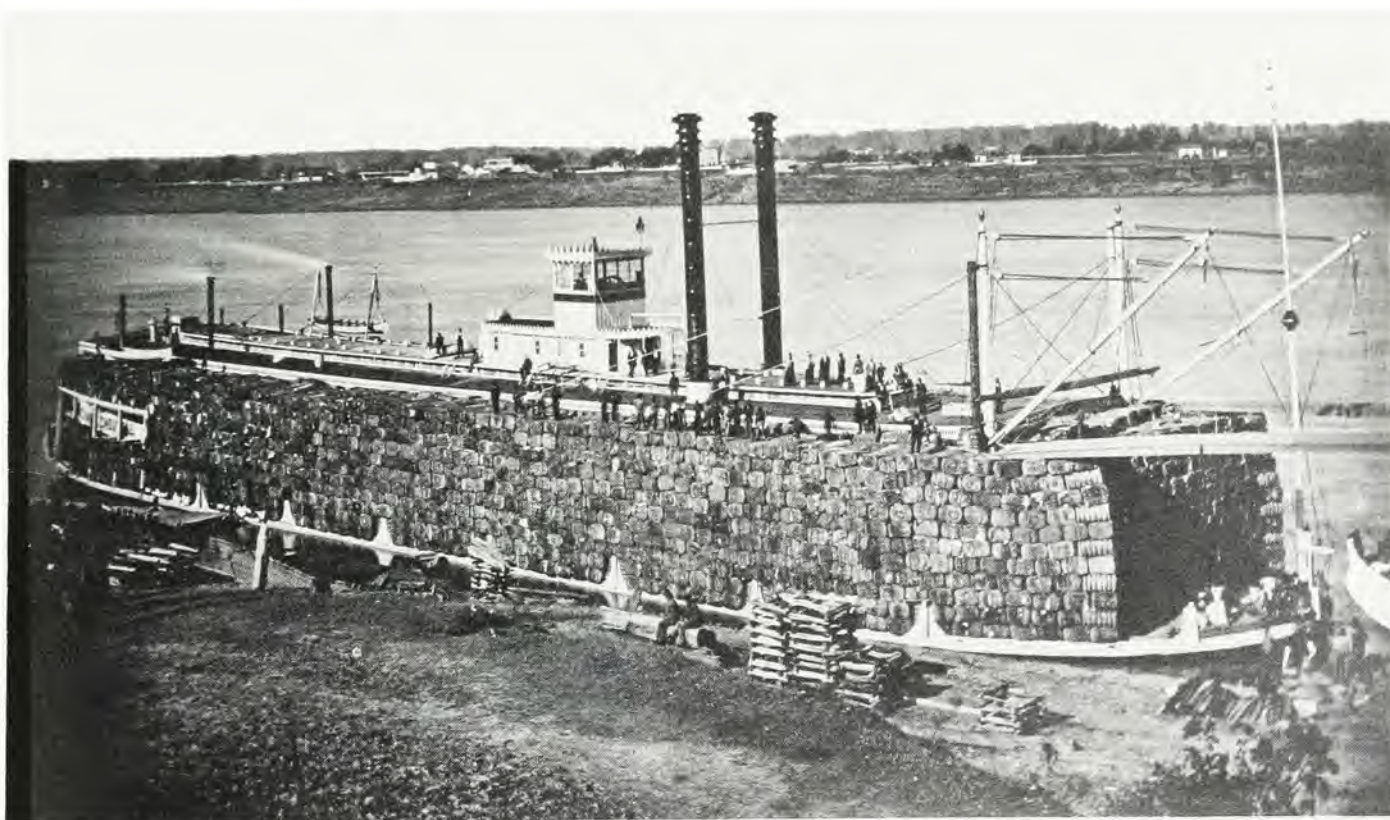
sippi had shifted in such a way that it was eroding the bend and threatening the new city waterworks as well as the stability of the northern wharf line. Protection of the bend was begun in October 1872. The method adopted was the construction of a longitudinal dike to prevent further erosion; to guard the foot of the dike against "scour" (erosion by the current) brush was piled against its base and weighted down with riprap (broken stone). The bank above the dike was then revetted. Work on Sawyer's Bend continued in years when funds were available until 1879.¹¹

The expenditures of the city and private corporations prior to 1870 to improve the harbor had been primarily funneled into the construction of dikes

from the Illinois shore in order to maintain a narrow and permanent channel with stable banks throughout the Harbor. Of four dikes erected along Venice Bend, on the Illinois shore, the 1872 Board of Engineers recommended that three be raised and extended to insure the stability of the channel. Appropriations were sufficient at the time to raise and extend only one of the dikes (Long Dike), but the effects of the work proved so beneficial that the other two dikes were never altered.¹²

Another Board recommendation called for removal of a sand bar in front of the Alton Harbor. The bar in front of Alton was analogous to the Bloody and

Duncan's Islands experience of St. Louis in the 1830s and 1840s; the solution was similar as well. Ellis Island, opposite Alton, was the culprit; a large part of the channel of the Mississippi was passing on the Missouri side of the island, thus allowing a deposit to build up in front of Alton Harbor. The remedy was found in the erection of a low dam, constructed of brush and stone to a height of eight feet above low water, across the western channel. This dam forced the Mississippi to flow in front of Alton Harbor during periods of low water as well as high water. The results were positive; the bar disappeared within a short time.¹³



—Missouri Historical Society

The steamboat *Charles P. Chouteau* (1877-1886), carrying the largest shipment of uncompressed cotton (8844 bales) ever unloaded at New Orleans. The steamboat was built in the St. Louis area and was named after a prominent St. Louisian who was part owner of the boat.

Although the surveying and planning for these projects, and in some cases the construction, were begun under Colonel Raynolds, most of the actual implementation took place during the tenure of Colonel James H. Simpson, who relieved Raynolds on January 1, 1873. Like Raynolds, Simpson had a background as a Topographical Engineer and a western explorer. He had been in charge of exploring a route from Fort Smith, Arkansas, to Santa Fe, New Mexico, in 1849, and he had also reconnoitered the area from Santa Fe to the Navajo country. From 1853 to 1858 Simpson had been in charge of road surveying and construction in the Minnesota Territory. It was during that period that he established a reputation as a strong-willed officer who did things his own way. He was a controversial figure in Minnesota, and he came under frequent attack in the local newspapers. The *Minnesota Democrat* began one article, "We do not like to say that Captain Simpson is an ass. Indeed, we do not think that he is—quite; if he were he would have shown less ears." Despite such abuse, according to one authority on the period, when Simpson left the territory he was rightly convinced that he had laid the groundwork for the Minnesota road system.

With the outbreak of the Civil War, Simpson was assigned to the 4th New Jersey Volunteers and saw action in the Peninsular campaign, at Westpoint, Virginia, and at Gaines's Mill, where he was taken prisoner. After being exchanged, Simpson spent the rest of the war supervising engineering projects in Ohio and Kentucky. His service in the St. Louis District brought to a close a distinguished and controversial career.¹⁴

The projects begun by Colonel Raynolds were designed to expedite commerce and to protect or restore conditions favorable to commercial interests in St. Louis and Alton. Simpson's approach would differ very little from Raynolds'. Under Simpson's direction, a plan was articulated and undertaken to improve the navigability of the Mississippi by confining the river to a single stream during low stages, containing it within a width of about 2500 feet. If this goal could be attained, the Mississippi would



Colonel James H. Simpson
District Engineer, January 1, 1873-March 30, 1880.

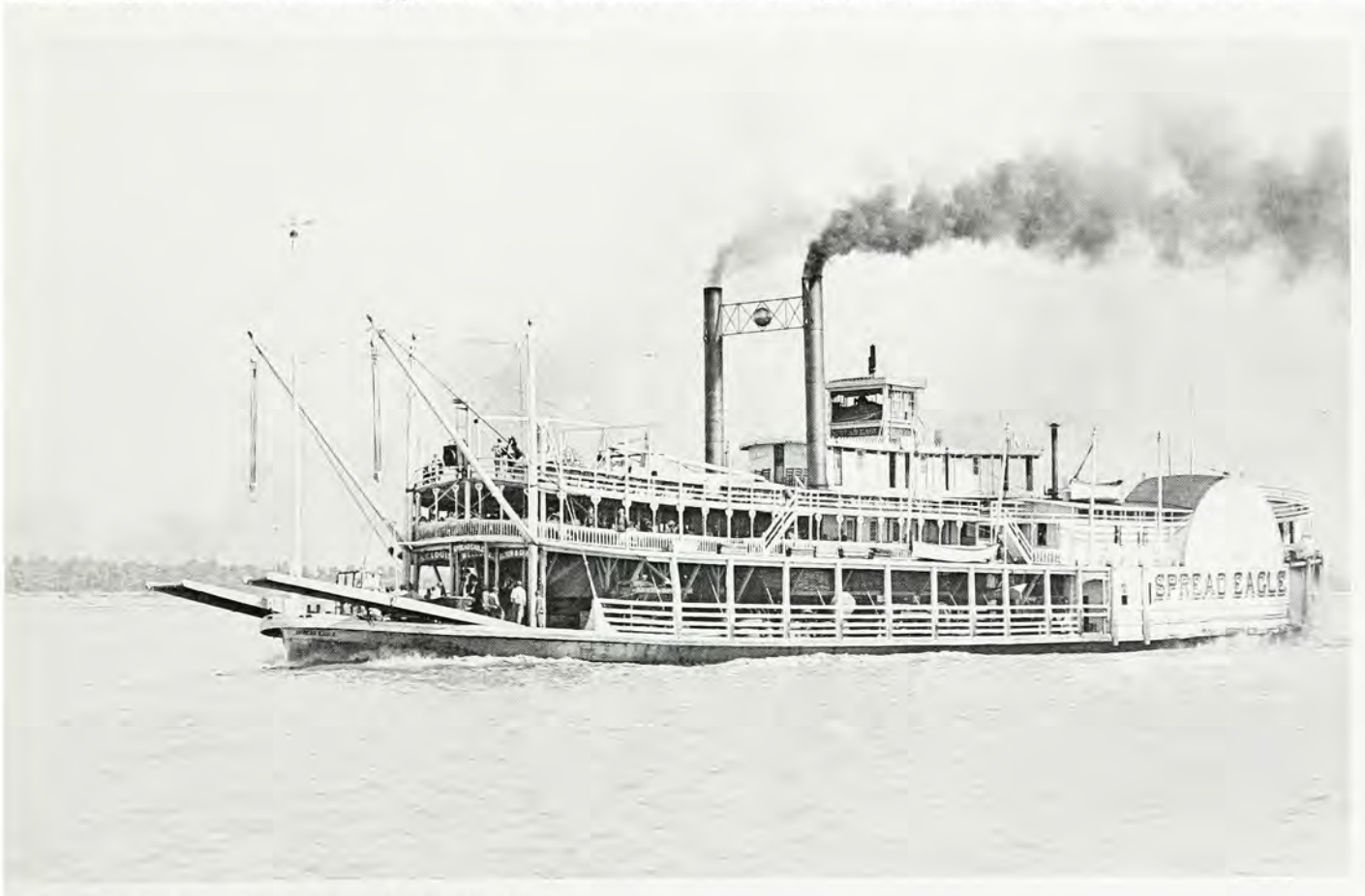
have a greater depth during low water and would be less susceptible to the formation of shoals or bars. While Simpson was District Engineer (1873-1880), the method used was the construction of low solid dikes and dams similar to those in Alton and St. Louis Harbors in order to contract excessive widths and close secondary branches of the river. Revetment of weak alluvial banks was also undertaken to prevent widening of the channel through erosion. These methods would be changed by Simpson's successor, but at the time they represented the best engineering thought of the day.¹⁵

The first project begun specifically for the improvement of navigation in the St. Louis District (which at this time extended from the mouth of the Illinois River to the mouth of the Ohio River) was at Horsetail Bar, immediately below the St. Louis Harbor (extending from the mouth of the River Des Peres to the head of Carroll's Island). The object of the improvement was to remove the bar by contracting

the channel to 2400 feet through the construction of five dikes. When the stream was forced to follow a narrower channel it washed away the offending bar and provided deeper water for navigation. This improvement was typical of the projects during Simpson's stay in office. Other dikes were constructed at such colorful localities as Fort Chartres, Towhead, Turkey Island, Devil's Island, Piasa Island, and Liberty Island.¹⁶

Even though these improvements were often isolated from population centers, at times the decisions of the District Engineer could be crucial in determining the future of small river towns. A notable instance was the case of Rockwood, Illinois, situated on the Mississippi in front of Liberty Island. Liberty Island separated the Mississippi into two distinct

channels, and the Engineers, in keeping with their policy of closing one channel to assure adequate depth in the other at low water, decided to close the western channel in order to protect the interests of Rockwood. But after the high water of 1875 the Mississippi made its own choice, virtually deserting the eastern channel. The Engineers waited a year in the hope that the Mississippi would revert back to the eastern channel; when it did not, Colonel Simpson reluctantly approved the plan to revet the Missouri shore. Although he was solicitous of Rockwood's interest, it would have been an expensive and difficult, if not impossible, undertaking to change the entire river's course. This incident was prophetic of the increasing importance of (and accelerating public interest in) Engineer decisions.¹⁷



The sidewheeler steamboat *Spread Eagle* (1893-1916).

Steamboat Accidents and Fatalities, 1860-1889

Kind of accident	Mississippi River System	
	Accidents	Lives lost
Explosion		
1860-1869	28	1,983
1870-1879	38	175
1880-1889	38	174
Fire		
1860-1869	75	351
1870-1879	79	105
1880-1889	127	166
Collision		
1860-1869	16	85
1870-1879	87	31
1880-1889	91	20
Snagged		
1860-1869	57	17
1870-1879	161	44
1880-1889	188	58
Wrecked or foundered		
1860-1869	65	106
1870-1879	60	49
1880-1889	125	51
TOTALS	1,235	3,415

Source:

Louis Hunter, *Steamboats on the Western Rivers*.

The interest in Engineer policy-making was less pronounced, however, than the interest in Congressional appropriations, which, although more plenti-

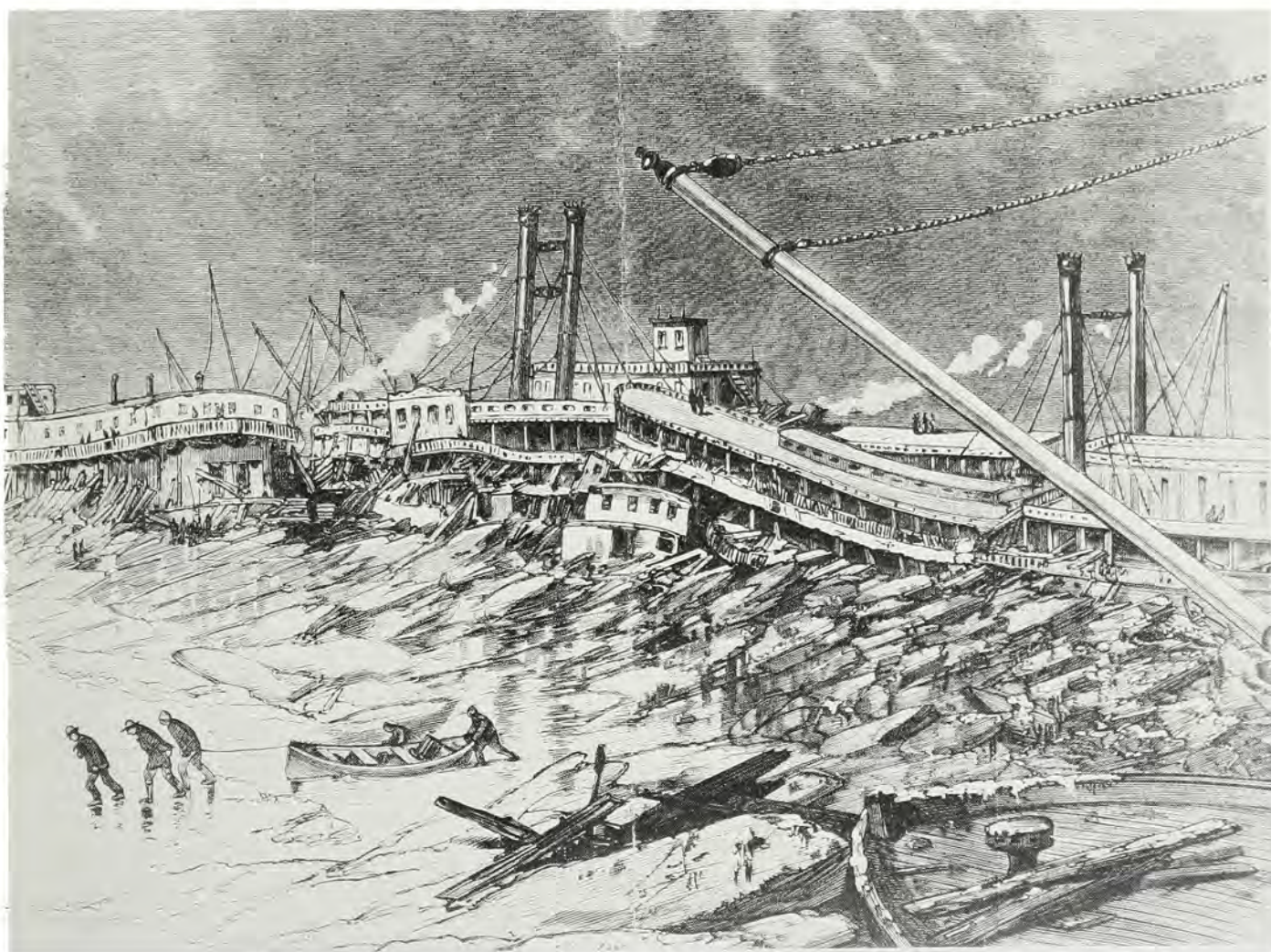
ful than before the Civil War, continued to fall short of requests. For example, the Missouri State Grange called on Congress to escalate spending for western river improvement; farmers were especially interested in the fate of river navigation because they saw a healthy river commerce as the only means of keeping railroad rates low and thus assuring cheap transportation of farm products. Colonel Simpson believed that the work of the St. Louis District was accomplishing just that objective. "The works now in progress and contemplated in the portion of the river under my charge will still further facilitate the cheapened transportation by removing the occasion of delays. Removing the causes of danger and delay, the result will be safe and expeditious transportation, which is synonymous with cheap transportation."¹⁸

Yet Congress had to provide sufficient funds to prosecute those improvements, and some St. Louisans suspected that they were being short-changed. As the *St. Louis Globe-Democrat* put it, "The unjust course which has been pursued by Congress in voting large appropriations for insignificant and comparatively unknown creeks and harbors in the Atlantic and Northwestern States, while the great artery of the Mississippi Valley was comparatively neglected, has more than once excited the indignation of the West." Although the editor recognized that pressures of constituents led to such inequities, he was appalled that "millions have been lavished at unimportant points, while a few paltry hundred thousands have been unwillingly doled out to keep up the improvements on the Mississippi." The lesson was clear, he concluded: "As the price of liberty is eternal vigilance, so the price of a river appropriation is assiduous bull-doing of the M.C.'s [Members of Congress], and river men can not do better than take this truth to heart."¹⁹

Evidently Colonel Simpson bore the brunt of some of this criticism, even though he had no control over the amount of appropriations. His pique at being made a scapegoat was apparent in his 1877 report, in which he remonstrated with Congress for awakening expectations by appropriating funds sufficient to start numerous projects but not to finish them. He

warned that “unless Congress is disposed to grant more liberal appropriations than have been given hitherto, it will be advisable to modify the plans and limit each year’s work to one or at most two localities, and take up new undertakings only as those now begun are completed.” Furthermore, Simpson pre-

dicted, “with annual appropriations of \$200,000, as have prevailed, it is my belief that the improvement will occupy at least a century and will cost \$20,000,000.” He emphasized that although a number of new projects were needed, “the financial limit is absolute and the engineers not at fault.”²⁰



—Missouri Historical Society

Destruction of Mississippi Steamboats by an Ice-Jam from Frank Leslie's Illustrated Newspaper, January 6, 1877.

Although Congress would give some increase in appropriations, the answer to Simpson's dilemma lay not in more money but in less expensive means of constricting the Mississippi's channel. A young Captain of Engineers, Oswald H. Ernst, replaced Captain Charles J. Allen as Simpson's assistant on September 28, 1878. He brought with him a new outlook and new engineering ideas which would radically alter the expense and speed of channel contraction along the Mississippi. Oswald Herbert Ernst, 36 years old, was a Civil War veteran and former instructor at the Military Academy. He was a man of considerable intelligence and industry who was destined to hold a succession of high offices later in his career. After serving as superintendent of public buildings and grounds at Washington (1889-1893) and superintendent of the Military Academy (1893-1898), he would command a brigade in the War of 1898 and then serve as Inspector-General in Cuba (1898-1899). He would also become President of the Mississippi River Commission and would be named a member of the Isthmian Canal Commission and the International Waterways Commission.²¹

While Simpson came to St. Louis at the end of his career, Ernst arrived when his had just begun. This difference was highlighted by their divergence in policies and attitudes. For example, Ernst seems to have been much less solicitous of local interests than Simpson. Ernst interpreted his duties very narrowly; his primary obligation, he felt, was to improve conditions for through navigation, not harbors or landings or other projects desired by local merchants. He reasoned that if Congress wanted something other than navigation improved, it could so specify in the appropriations bills. It was Ernst, too, who would abandon the solid dikes and dams used by Simpson and his predecessors in favor of hurdles and other permeable structures in the narrowing of the river. Furthermore, he established the principle of improving the river continuously downstream from St. Louis, on the assumption that up-river improvements might render some down-river improvements unnecessary, while the obverse situation, proceeding upstream from Cairo would undoubtedly lead to



Major Oswald H. Ernst
District Engineer, March 31, 1880-November 12, 1886.

improvements down-river which would be utterly useless after up-river projects were completed. The use of permeable structures and the procedure of working continuously downstream would establish the parameters of Engineer policy in the St. Louis District for the rest of the century and beyond. The goal of this work, after 1881, was to secure a channel with a minimum depth of eight feet.

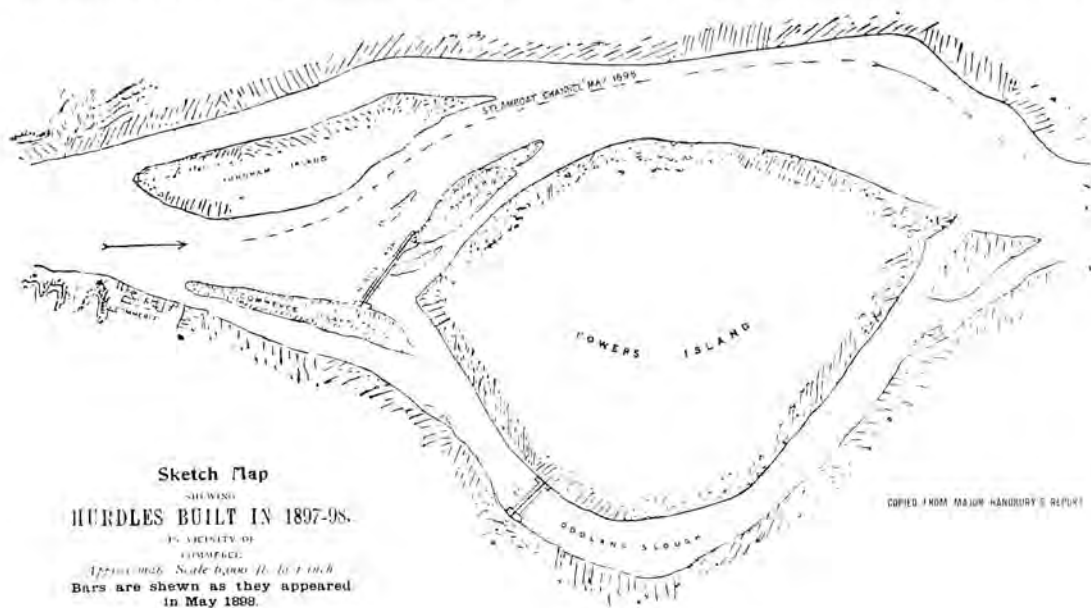
Captain Ernst assumed charge of the St. Louis District on March 30, 1880. For the year and a half prior to that date he had assisted Colonel Simpson. During that period Simpson demonstrated that he was not irremediably tied to the old way of doing things. He encouraged Ernst to proceed with the design of a hurdle, which Ernst had evidently suggested to Simpson as a plausible tool for channel contraction. The hurdle would prove to be a significant improvement over the stone dikes, in terms of efficiency, expense, and ease of construction. The purpose of the hurdle was to let the river itself provide the materials for channel contraction. It was "a dikebuilder rather

than [a] dike." The Missouri River empties a tremendous amount of silt into the Mississippi; if the Mississippi could be induced to leave this silt in the appropriate places, sloughs could be filled and the channel narrowed as the silt formed new banks for the river. To construct a hurdle, a row of piles five feet apart was interwoven with willow brush "something after the manner of military hurdles." Then vertical branches were inserted to fill any voids so that no large holes were left in the hurdle. These permeable barriers slowed the water sufficiently so that silt would settle behind the hurdles; actually the "impermeable" stone dikes had allowed some water through too, but not enough to form meaningful deposits. A short time after the first hurdles were built, Simpson reported that "the efficiency of such a hurdle in creating deposit has been remarkable."²³

Simpson embraced the use of hurdles in conjunction with solid structures—the first hurdles, at Horsetail Bar, were appended to a training wall or longitudinal dike. But after Ernst assumed command of the District, solid dikes were virtually abandoned in favor

of the cheaper, more efficient hurdles. In 1879, a stone dike cost \$9.75 per linear foot, while a hurdle cost \$.80 per linear foot. There would continue to be occasional instances where solid dikes were necessary, especially when immediate deflection of the current was called for. In these cases, the river was being used to do a different kind of work, since the usual object in such an instance was to deflect the channel so that it would wash away a shoal or bar. Thus, by the 1880s the Engineers of the St. Louis District had evolved a sound system of river improvement based on the principle that the river itself should be used to do the necessary work wherever possible.²⁴

In his first year as District Engineer, Ernst also supervised the development of a hurdle for use in deep water. When the depth was too great to drive piles into the riverbed, a floating hurdle or curtain was used. One end was secured to the bottom by anchors, while the other was held up at the surface by buoys. This induced the river to deposit enough silt so that stationary hurdles could be used.²⁵



Major Handbury's 1898 map showing the placement of hurdles to restrict the flow of the Mississippi to the desired channel.

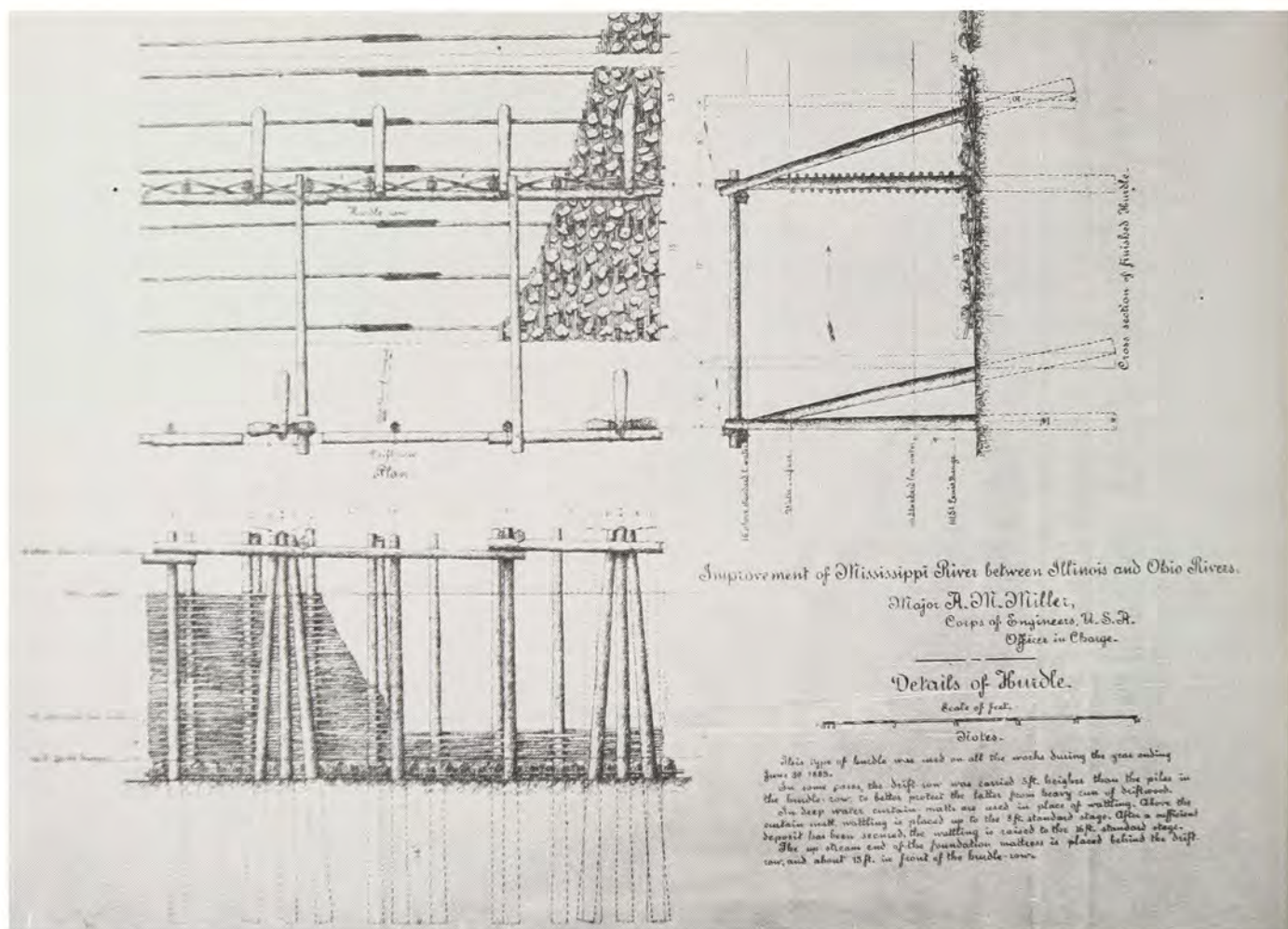


Diagram of piling dikes (hurdles) used in river contraction works.

But building new banks and closing sloughs or chutes was only part of the solution to contracting the river. It was also necessary to prevent existing banks from eroding further. The solution applied by Colonel Simpson at Sawyer's Bend in St. Louis Harbor was effective, but extremely expensive and time-consuming. Here, too, Captain Ernst adopted a more efficient and economical method of accomplishing the objective than had his predecessors. (This difference in approach might be attributed to the fact that both Raynolds and Simpson had spent most of their careers in the Topographical Engineers, while Ernst's career had been entirely in the Corps of Engineers). The banks of the Mississippi are primarily alluvial and thus

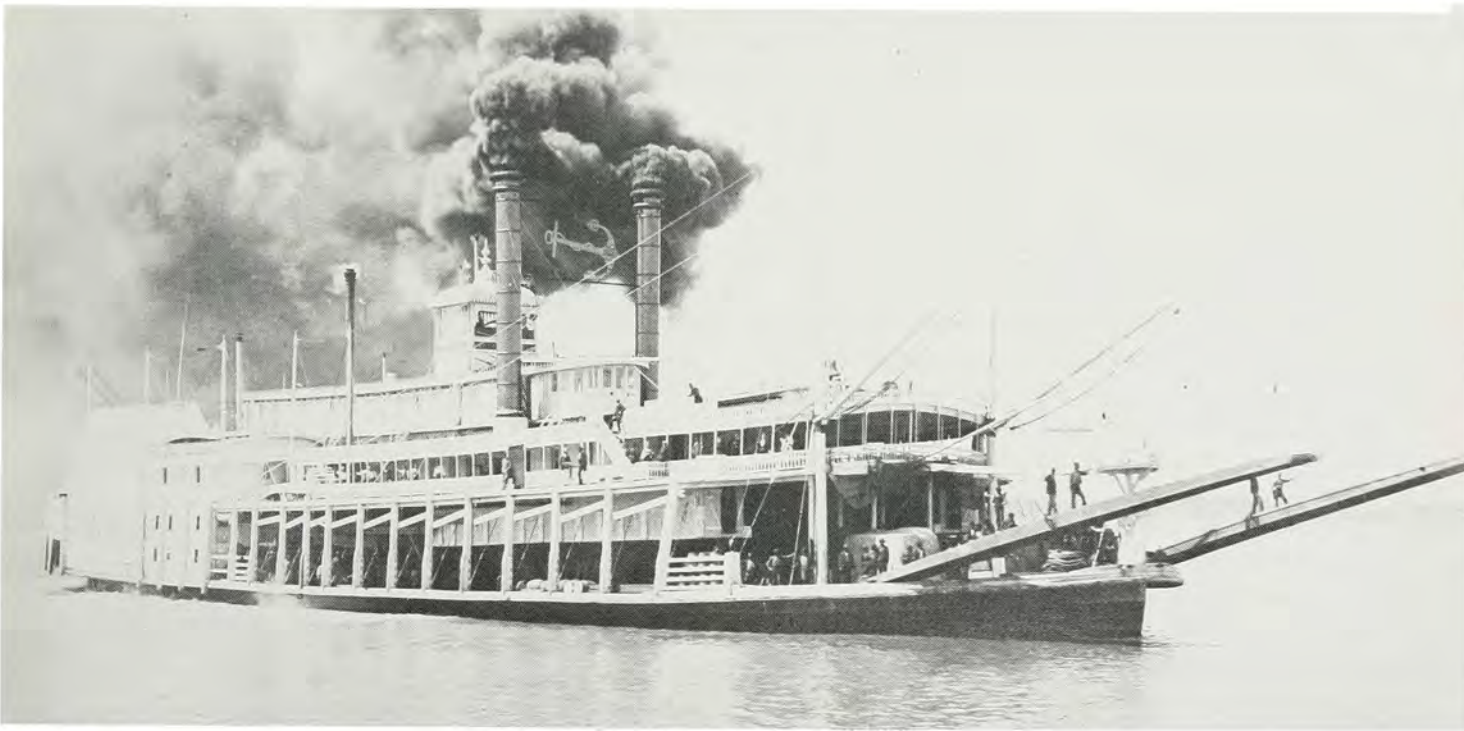
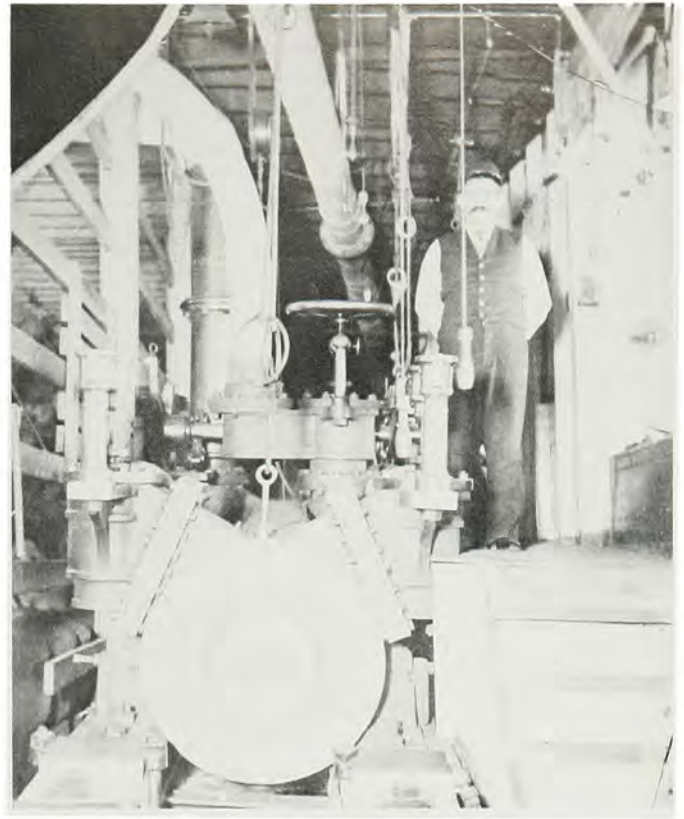
given to caving. This tendency was responsible for the snag problem discussed in the previous chapter, and snags continued to be a problem; in 1887 the District Engineer assumed responsibility for their removal from a large section of the Mississippi.²⁶

Henry Shreve had suggested that snags could be prevented by clearing the banks for a given distance from the river so that trees would not topple in when the banks caved. To a limited extent this policy was followed by the Engineers who succeeded Shreve, although not to the degree he proposed. Rather, they cut down trees which appeared to be in imminent danger of falling into the river. Even so, this policy would prove to be contradictory to the policies

—Missouri Historical Society

Engine room of *City of St. Louis*.

advocated by Ernst for improvement of navigation, which actually called for planting trees on the banks. A far greater offender than the tree-removing Engineers, however, was the farmer. As he cleared land for cultivation, he weakened the holding power of the banks, and as Ernst noted, "weakened banks permit more rapid erosions, give the river greater width, and therefore less depth, and the navigation is injured." Ernst went on to point out that "wooded banks yield finally, of course, but the rate of erosion is so slow that the river has time to build up on the opposite side, and there is no increase of width."²⁷



—Missouri Historical Society

Steamboat *City of St. Louis* (1883-1903).

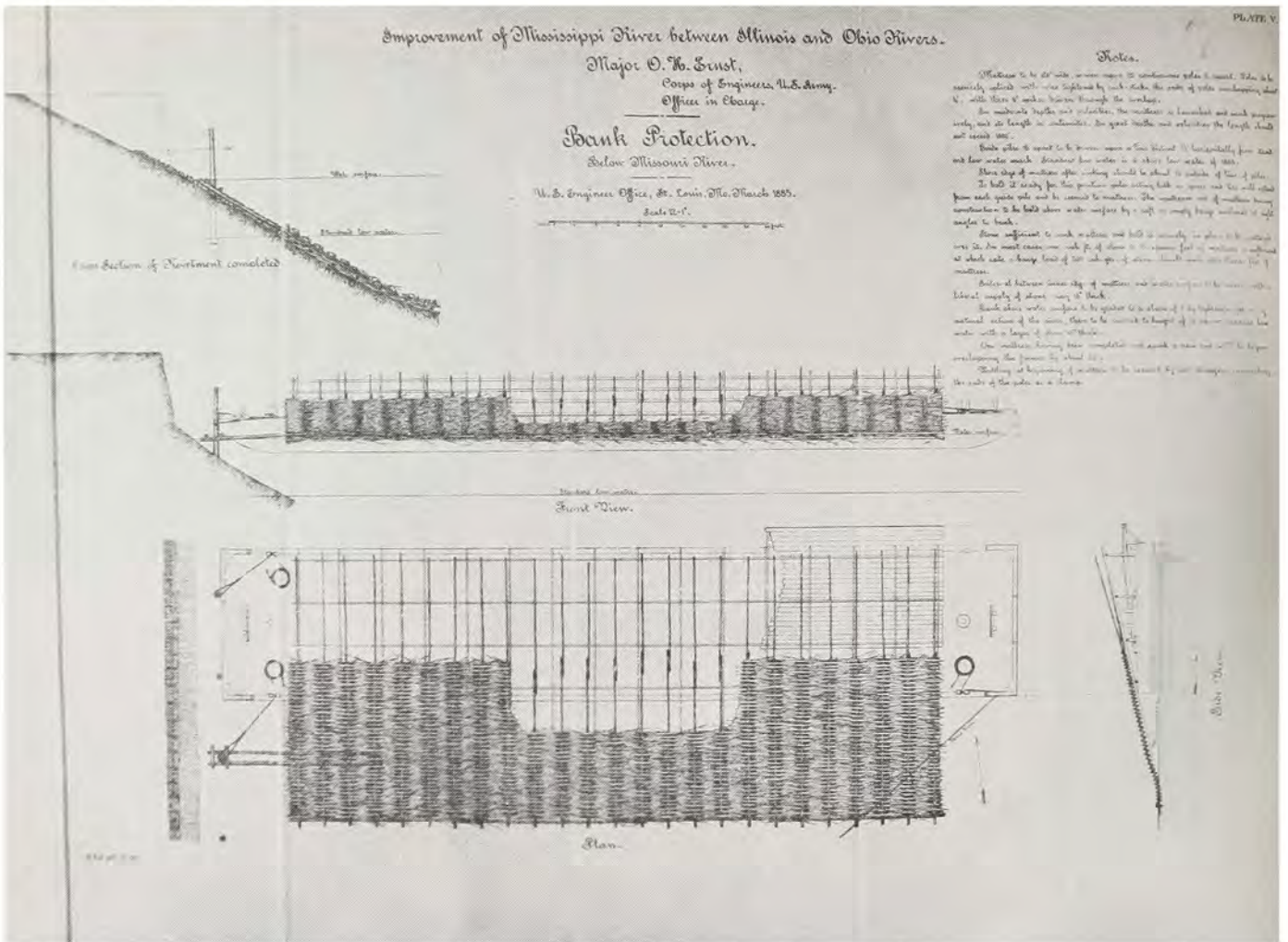


Diagram of mattress revetment first used in the late 19th century.

As the Missouri-Illinois area became more densely populated, the problem increased; it was at its worst at concave bends in the river, where the current struck the bank head-on. Captain Ernst adopted an ingenious system for strengthening these banks. He divided the bank into three horizontal zones: the first extended from the lowest point of erosion to the low water mark; the second, from low water mark up to a level where willow trees would grow; and the third, from the latter point to the top of the bank. The lower zone was protected by a mattress of interwoven brush weighted against the bank by rocks. The second level, because it would be alternately above and below water, would not be suited for a brush mattress, which would quickly rot, so riprap was used. In the upper zone, a live stand of willows was planted. In connection with this plan to use willows, Ernst began a scientific study of willow transplanta-

tion under controlled conditions to determine the most advantageous manner of planting. This system of bank protection proved very effective and was used extensively in the stretch from St. Louis to Cairo.²⁸

In 1882 Ernst instituted several changes to increase the efficiency of the St. Louis District. First, he implemented a new scheme of organization. A civilian superintending engineer was appointed to oversee all the works in the field, as well as the operation of the newly-acquired supply depot. Each field project had a resident engineer who was responsible to the superintending engineer. The acquisition of a supply depot made it possible to purchase goods in bulk on favorable terms and to have material on hand when it was needed. Ernst also greatly increased the number of steam pile-drivers available for work and acquired a hydraulic excavator. Another sign of



Major Alexander M. Miller
District Engineer, November 13, 1886-March 4, 1893.

Ernst's use of new technology was his agreement with Bell Telephone Company for the installation of a private line from the Engineer's Office at 404 Market St., and from the Supply Depot on the riverfront, to the various sites of construction downriver. This new instant communication greatly facilitated supply, decision-making, and supervision of the work.²⁹

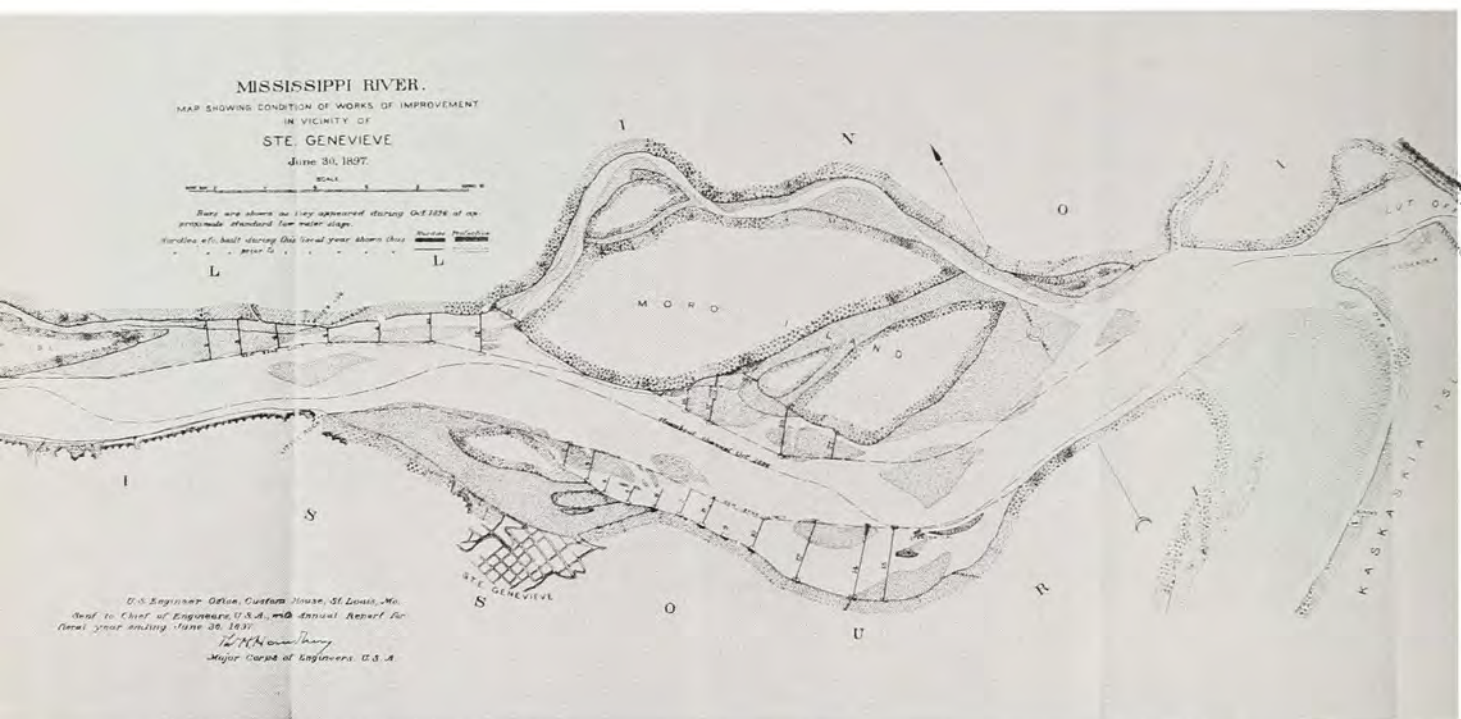
But due to forces beyond Ernst's control, between 1884 and 1887, the organization of the District was in a state of turmoil. The River and Harbor Act of 1884 placed the St. Louis District under the control of the Mississippi River Commission, which, since its creation in 1879, had been in charge of the Mississippi from Cairo to the mouth. Evidently this experiment proved unsatisfactory, because the River and Harbor Act of 1886 returned the supervision of the District to the Chief of Engineers. In the meantime, the boundaries of the District were also in flux. After having been in charge from time to time of improvements on the Osage, Gasconade, Cuivre, Meramec, and other smaller rivers in Missouri, and the Kaskaskia in Illinois, in 1886 Ernst had only the Mississippi from the mouth of the Illinois to the mouth of

the Ohio under his jurisdiction. Then, in 1887, not only were the lesser rivers returned to the District, but also the responsibility for removing snags and wrecks from the Mississippi and Missouri Rivers was added to the District's duties.³⁰

On November 13, 1886, Major Ernst was relieved by Major Alexander Macomb Miller. Ernst had played an important role in the development and modernization of the St. Louis District. Furthermore, he had adopted techniques of river improvement which would set the parameters for District operations for many years to come. By the time Ernst left the District, improvement works had been initiated as far as 154 miles downriver from St. Louis. Few District Engineers would establish so remarkable a record.³¹

A. Macomb Miller had graduated third in the class of 1865 at West Point. A man of considerable erudition, he published a translation from the French of Barois' "L'Irrigation en Egypte" while stationed at St. Louis. During his stay as District Engineer, Miller was relegated primarily to completing projects begun by Ernst, in large part because appropriations became more infrequent and inadequate. The only significant works begun under Miller were the narrowing of the channel between Bissell's Point and Eads Bridge in St. Louis Harbor (by construction of a dozen hurdles on the Illinois side), the maintenance of the Little Rock landing for Ste. Genevieve (a series of hurdles on the Illinois side were built to force the water to the Missouri bank), and the improvement of the Kaskaskia River.³²

This last project was notable because it represented the most ambitious undertaking up to that time in the District on a tributary stream. Work on the Kaskaskia posed quite different problems from those encountered on the Mississippi. Two shoals existed between the mouth of the Kaskaskia and Evansville, Illinois—Nine Mile Shoal and Evansville Shoal. Nine Mile Shoal was composed of very hard limestone mixed with flint. Despite the hardness of the rock, a channel seventy-five feet wide and thirty-six inches deep was successfully excavated. Evansville Shoal presented yet another kind of problem—



Engineer improvements on one stretch of the Mississippi as shown in an 1897 map by Major Handbury.

it consisted of "stone boulders [sic], blue clay (gumbo) mixed with gravel and muscles [sic]." Blasting did little good in the clay, so a cofferdam had to be built to keep water out of the excavation site; men were then put to work with picks and shovels. The channel cut through this shoal was sixty feet wide and thirty-four inches deep. The result of these excavations was a substantial increase in shipping on the Kaskaskia; steamboats could now ply the river to Evansville for a much longer season. In the coming century, work on the tributary streams would assume increasing significance.³³

On March 4, 1893, Miller was relieved by Major Charles J. Allen. Major Allen's primary contribution to the Engineers' efforts to improve navigation lay in his experimentation with temporary expedients to deepen channels across bars. The first experiment



Major Charles J. Allen
District Engineer, March 5, 1893-January 10, 1896.



Lieutenant Chester Harding
District Engineer, January 10, 1896-January 13, 1896.



Major Thomas H. Handbury
District Engineer, January 13, 1896-March 21, 1899.

was with a jet dredge or bottom sand agitator; it was equipped with two jet pumps capable of throwing 5000 gallons of water per minute each. The effect was to wash away the sand and create a channel through the bar. Another experiment posited the use of portable jetties. Utilizing corrugated iron sheets riveted together, the Engineers could put up a large jetty in four days. After the jetty had accomplished its purpose for the season, it could be removed and used again the following season.³⁴

These temporary expedients proved so beneficial that their use was institutionalized by Allen's successor, Major Thomas H. Handbury. Portable jetties were used extensively throughout the St. Louis District. But Handbury's real interest was in dredging, and he designed several hydraulic dredges which represented substantial improvements over the jet dredge used by Major Allen. He adopted a suction system which allowed the dredge to pump the sand out of the bar to a distance of 500 feet from the channel being cut. Handbury correctly predicted that this type of dredge would be used to great advantage in conjunction with portable jetties.³⁵

By the end of the century, then, the Engineers had made significant progress in improving the navigation of the Mississippi River from the Missouri to the Ohio. The important harbors at St. Louis and Alton had been protected, permanent improvements in the channel of the Mississippi had been made, and temporary expedients had been developed to assure prompt relief from newly-formed obstructions. In addition, the District had assumed direction of snag removal, which had been regularized by the River and Harbor Act of 1888 permitting an annual expenditure of up to \$100,000. The construction and use of iron-hulled boats had increased the efficiency of snagging operations. New approaches were also tried in removing sunken vessels from the channel; divers were hired to place dynamite in the wrecks, which were then demolished. Thus, by 1900, the Engineers had developed methods for coping with most of the major problems hampering navigation on the Mississippi.³⁶

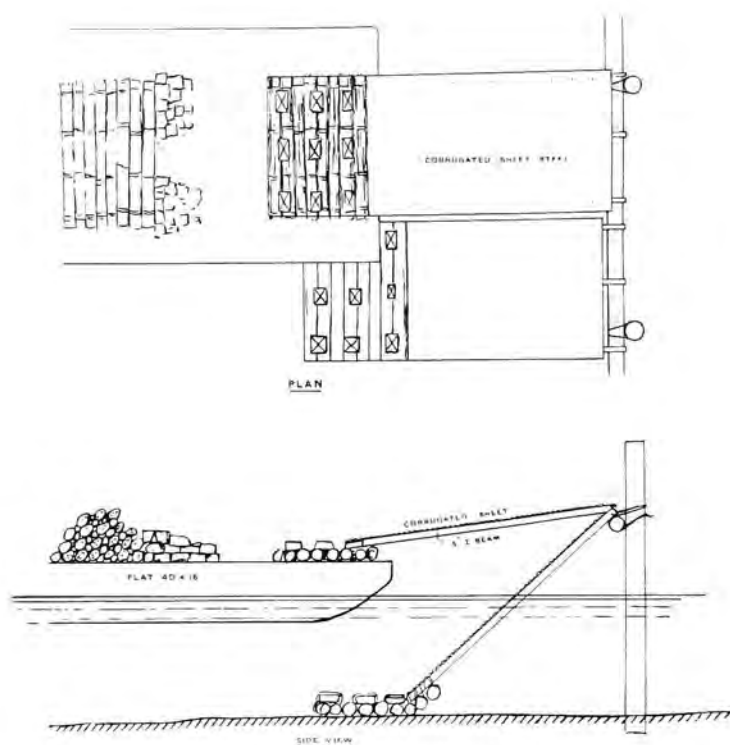
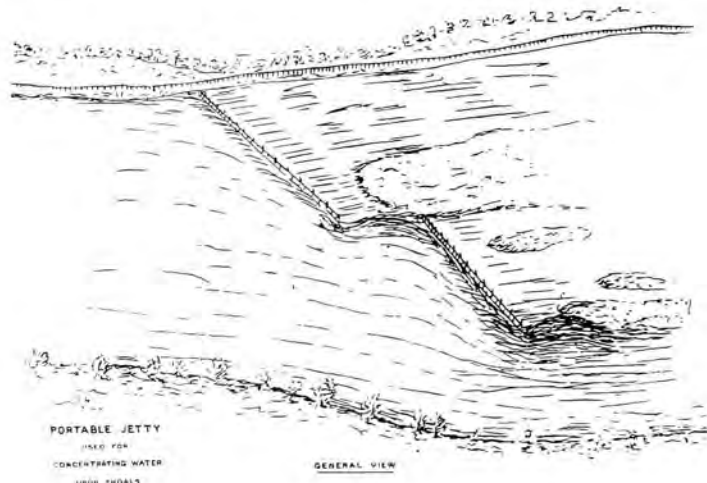


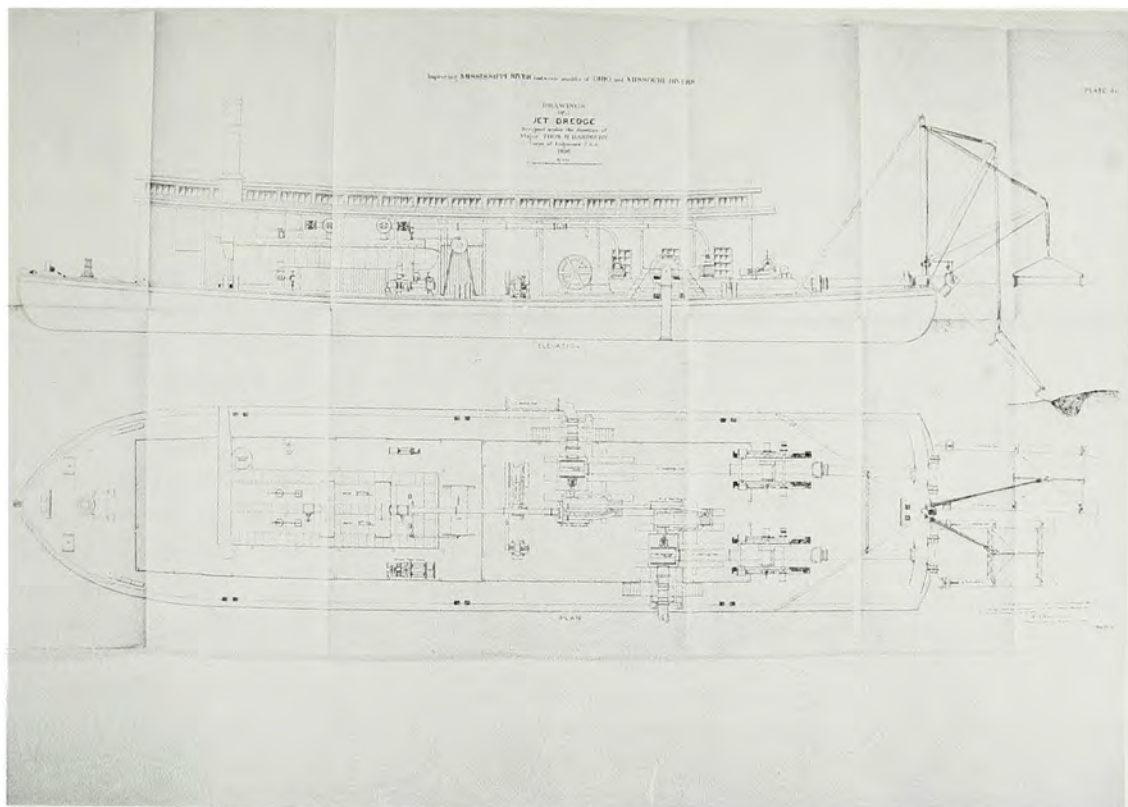
Diagram showing the construction of portable jetties and their effect on the river channel.

There remained impediments to navigation, however, over which the Engineers still had no control—low water, ice, and floods. “In approximately one-third of the years from 1865 to 1900 the reviews of the trade and commerce of St. Louis reported difficulties growing out of the unusual length of the summer and fall season of drought and low water, extending in most cases from three to as many as six months.” The large sums expended on river improvement could not alter the lack of water in the channel. Furthermore, the hazards posed by ice sometimes closed the river to navigation for another month. As if these woes were not enough, periodically the Mississippi would go on a rampage, wreaking havoc on boats, harbors, and channel improvements. In 1881 one such flood destroyed the little town of Venice, Illinois, opposite the northern wharf in St. Louis Harbor. In 1892, over \$10,000,000 in damages was inflicted on the East Side by the turbulent waters of the Mississippi. As the Engineers gained greater experience

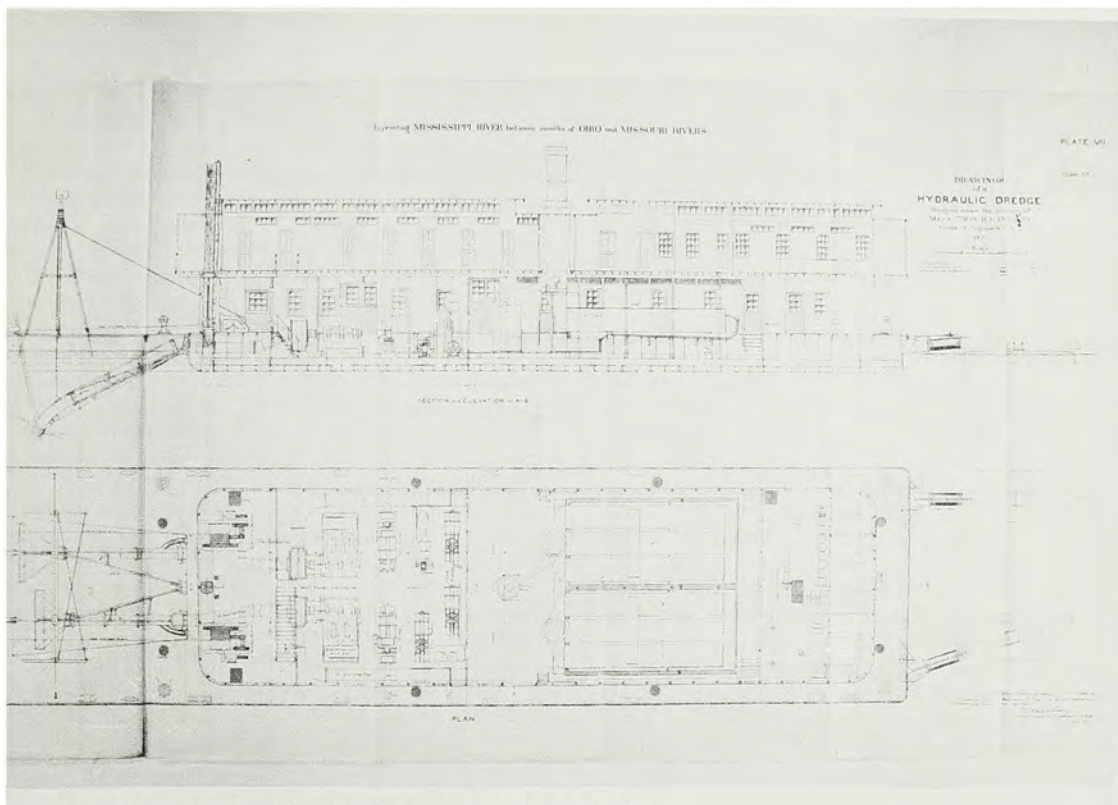


in dealing with the river, they realized that flood control would be a necessary part of navigation improvement; besides, pressure was beginning to build for flood control to protect people and property.³⁷

The Mississippi River Commission, created in 1879 to improve navigation from the mouth of the Ohio to the mouth of the Mississippi, had as one of its charges the prevention of destructive floods. Although the intent was that the Commission would provide technical assistance to local agencies for flood protection rather than assuming responsibility for the actual work, in practice the federal government had been involved in levee building on the lower Mississippi since 1882. However, there was still wide disagreement about whether the federal government ought to be responsible for flood control. In the dawning new century that debate would be resolved in the affirmative; the government could not sit idly by and allow the Mississippi to exact its terrible toll of lives and property.



Drawing of the jet dredge designed by Major Handbury.



Drawing of the hydraulic dredge designed by Major Handbury.

The formation of the District, the procession of strong and colorful District Engineers who manned the office, and the numerous technological developments of the period combine to make the years 1865-1900 especially important in the development of the St. Louis District. Innovations such as hurdles, bank revetments, and hydraulic dredges were necessary for a systematic attack on the problems posed by the middle Mississippi and would be utilized by the District for years to come. Likewise, having Engineers on the local scene on a continuing basis was a necessary part of identifying and remedying problems on the river before such problems interrupted river traffic. The increasing efficiency of the Engineers in clearing the river and regularizing its channel would demonstrate the importance of the new District to safe and effi-

cient navigation. But its influence would ultimately extend far beyond navigation improvement. The impact of the Engineers was only beginning to be felt, and far-reaching new missions would evolve in the future.

While the importance of navigation on the middle Mississippi would continue to decline until World War I, and would never attain the relative importance it enjoyed prior to the Civil War, the growing activism of the Federal Government would combine with the natural disasters of the early twentieth century to assure the Corps of Engineers a larger and more important role in dealing with the mighty Mississippi and its tributaries. One of the most significant scenes of such activity would be the St. Louis District.

Footnotes Chapter 3

1. See Frank H. Dixon, "A Traffic History of the Mississippi River System," Doc. No. 11, National Waterways Commission (December 1909); Louis C. Hunter, *Steamboats on the Western Rivers* (Cambridge, Mass., 1949); and Wyatt Winton Belcher, *The Economic Rivalry Between St. Louis and Chicago, 1850-1880* (New York, 1947).
2. Dixon, "Traffic History," 38; Belcher, *Economic Rivalry*, 173-75; Hunter, *Steamboats*, 566.
3. Dixon, "Traffic History," 39; Hunter, *Steamboats*, 566-84; Belcher, *Economic Rivalry*, 193-96.
4. Hunter, *Steamboats*, 584, 601; Dixon, "Traffic History," 50.
5. H. J. Hopkins, *A Span of Bridges: An Illustrated History* (New York, 1970), 141-48; Joseph E. Vollmar, Jr., "The Incomparable Mr. Eads," *Sunday Magazine, St. Louis Globe-Democrat* (June 30, 1974), 4-11. See also Rosemary Yager, *James Buchanan Eads: Master of the Great River* (Princeton, N.J., 1968), and Gerald R. Polinsky, "The Construction of the Illinois and St. Louis Bridge (Eads Bridge) at St. Louis, 1867-1874," (unpublished M.A. thesis, Washington University, 1954).
6. Arthur Morgan, *Dams and Other Disasters* (Boston, 1971), 106-21; Vollmar, "Incomparable Mr. Eads," 11; U.S. Congress, House, *Reports on Bridge across the Mississippi River*. H. Doc. 43-194, 43rd Congress, 1st Session, 1-45, 1874. A similar controversy surrounded the first railroad bridge across the Mississippi, at Rock Island, Ill. See Benedict K. Zobrist, "Steamboat Men Versus Railroad Men: The First Bridging of the Mississippi," *Missouri Historical Review* 59 (January 1965), 159-72; Arthur

Frank, *The Development of the Federal Power of Flood Control on the Mississippi River* (New York, 1930), 157-69.

7. U.S. Congress, House, *Reports on Survey of Rivers and Harbors*. H. Doc. 42-34, 42nd Congress, 2nd Session, 2, 14-19, 1871; U.S. Congress, House, *Mississippi and Illinois Rivers; Memorial of the Fulton County, Illinois, Farmers Association*. H. Misc. Doc. 43-92, 43rd Congress, 1st Session, 1872; Isaac Lippincott, "A History of River Improvement," *Journal of Political Economy* 22 (1914), 651-52; Belcher, *Economic Rivalry*, 173.
8. *Annual Report of the Chief of Engineers*, 1871, 57-59, 306-7, 312-33; *Annual Report* 1872, 52-56, 348-67, 390-99; *Annual Report*, 1873, 53-57, 442-57, 469-77, 486-92. According to Professor Raymond Merritt, "Up to 1892 the projects were organized around the officer-in-charge and were not called districts until 1893. It is not until 1908, however, that the districts are given names and not until 1915 that they are described by geographic boundaries rather than projects under examination, construction or operation. The divisions had a similar evolution. Division engineers were first appointed in 1884 to supervise the officers-in-charge." Raymond Merritt, "The Corps and the District, 1866-1976," (draft in author's possession), 25.
9. Frank Smith, *The Politics of Conservation* (New York, 1966), 148; *Annual Report*, 1871, 306-7.
10. *Annual Report*, 1871, 322; *Annual Report*, 1872, 55, 358-66.
11. William Hyde and Howard L. Conard, *Encyclopedia of the History of St. Louis*, II, (New York, 1899), 986; *Annual Report*, 1873, 453-54.

12. *Annual Report*, 1872, 363-66.
13. *Annual Report*, 1873, 53, 442-46.
14. *Dictionary of American Biography*, XVII, 179; W. Turrentine Jackson, *Wagon Roads West: A Study of Federal Road Surveys and Construction in the Trans-Mississippi West, 1846-1869* (Berkeley, 1952), 24-28, 53-65, 147-57, 214-15, 293-94, 303-17.
15. *Annual Report*, 1894, 1587-88.
16. *Annual Report*, 1874, 326-29; *Annual Report*, 1875, 65, 479-80.
17. *Annual Report*, 1876, 640; *Annual Report*, 1894, 1591.
18. U.S. Congress. Senate, *Memorial Relating to the Mississippi River*. S. Doc. 44-39, 44th Congress, 2nd Session, 1-4. 1877; *Annual Report*, 1874, 330.
19. *St. Louis Globe-Democrat*, January 10, 1877.
20. *Annual Report*, 1877, 512; *Annual Report*, 1879, 1032.
21. *Annual Report*, 1879, 1025; *Dictionary of American Biography*, VI, 178-79; Frederick Haskin, *The Panama Canal* (New York, 1913), 135.
22. *Annual Report*, 1880, 1368; *Annual Report*, 1881, 1526-27, 1536.
23. *Annual Report*, 1879, 1028-29; *Annual Report*, 1880, 1362.
24. *Annual Report*, 1879, 1028.
25. *Annual Report*, 1880, 1362.
26. *Annual Report*, 1882, 1601-2; *Annual Report*, 1887, 210.
27. *Annual Report*, 1880, 1369.
28. *Annual Report*, 1882, 1601-3; *Annual Report*, 1881, 1523.
29. "History of the Engineer Depot." (Office of the District Engineer, St. Louis, Missouri, n.d.); *Annual Report*, 1882, 1592, 1603-4. Crime was no stranger to St. Louis in the 1880s, nor were the Engineers exempt from it. One of the early expenses of the Supply Depot was \$160.34 for a board fence "for the better protection of the public property from petty depredators." *Annual Report*, 1883, 1184. The Depot was also charged with provisioning the men working at the various projects. In 1883, the average cost of subsistence for each man per day, including administrative expenses, was forty-four cents. By the following year, the average had been reduced to forty-two cents, *Annual Report*, 1883, 1185; *Annual Report*, 1884, 1416.
30. *Annual Report*, 1885, 2855; *Annual Report*, 1886, 249-50; *Annual Report*, 1887, 210. In 1888, responsibility for removing snags from the Missouri River was turned over to the Missouri River Commission. *Annual Report*, 1889, 1673.
31. *Annual Report*, 1887, 1556.
32. George W. Cullum, *Biographical Register of the Officers and Graduates of the United States Military Academy*; *Annual Report*, 1894, 1587-92; U.S. Congress. House, *Mississippi River Appropriations*. H. Doc. 57-439, 57th Congress, 2nd Session, 646. 1903.
33. *Annual Report*, 1892, 1745-47.
34. *Annual Report*, 1896, 1722-23; E. F. Dawson, *Notes on the Mississippi River, including Brief Descriptions of the Methods Adopted by the Mississippi Engineers* (Calcutta, 1900), 167-79, 218-21. Dawson was Executive Engineer of the Bombay Presidency, sent to inspect the conservation works on the Mississippi River. Secretary of State William R. Day to Secretary of War Russell Alger, August 13, 1898. National Archives, Record Group 77.
35. Dawson, *Notes on the Mississippi*, 167-79, 218-21; Major Thomas H. Handbury to Brigadier General William P. Craighill, Chief of Engineers, March 20, 1896, National Archives, Record Group 77. From January 10 to January 13, 1896, the District was in the temporary charge of Lieutenant Chester Harding, *Annual Report*, 1896, 249.
36. *Annual Report*, 1894, 1568; Major Charles J. Allen to Brigadier General Thomas L. Casey, Chief of Engineers, September 30, 1893, National Archives, Record Group 77.
37. Hunter, *Steamboats*, 600; Dixon, *Traffic History*, 39-40; Scharf, *History of St. Louis*, 1066; Hyde and Conard, *Encyclopedia*, 795-96.
38. 21 *Statutes at Large*, 37-38; Frank E. Smith, *Land and Water*, I, (New York, 1971), 434.



In 1910, heavy ice wrecked the steamboat *City of Providence*, which was moored in St. Louis harbor.

From Navigation to Flood Control



—Missouri Historical Society

By the turn of the century St. Louis had grown to 575,000 inhabitants, making it the fourth largest city in the United States. Although river traffic was declining in importance, railroads more than compensated for that loss with their tremendous expansion. The railroads assured St. Louis a continued vital role as supplier of goods for the South and Southwest, as well as a great part of the Northwest, the West, and Mexico. During the last decade of the nineteenth century, business done by St. Louis merchants nearly doubled. By 1900, St. Louis led the nation in the distribution of dry goods, footwear, hardware, and furs “of the cheaper sort.”

St. Louis had also become the fourth leading city in the United States in manufactures, with over seven thousand factories of various sizes operating in the area. It led the nation in the manufacture and sale of tobacco (more than three-fourths of the country's plug tobacco), beer (75,000,000 gallons a year), wood-ware, and steam and street railway cars. The assessed value of property in St. Louis was \$380,000,000. Together, the railroads and steamboat lines carried in and out of St. Louis thirty million tons of merchandise a year. Clearly, St. Louis had become a major center of the American economy. Yet its reputation as part of the Wild West persisted, and one writer noted with some surprise that “nearly five hundred miles of the nine hundred miles of streets in the city are well paved.” The World's Fair of 1904 would serve to disabuse the public of some of their prejudices toward St. Louis, but the greatest single factor in changing national perceptions of the city was its continued growth. By 1927 the assessed value of property had increased eightfold and by 1930 the population exceeded three-quarters of a million people.¹

As St. Louis grew in importance, the local District of the Corps of Engineers also became more significant. During the first quarter of the twentieth century, the Corps of Engineers at the national level moved from a strict navigation-orientation toward a more comprehensive planning approach to water resource utilization. Flood control, hydroelectric power production, and irrigation joined navigation as proper areas of concern for the Corps, and as this transformation in mission took place, St. Louis became an even more important center of Corps activity. Although the amount of work done during the first three decades of the twentieth century in the St. Louis District pales into insignificance compared with the amount accomplished during the thirties and after, it was nevertheless a necessary period of transition in terms of the mission of the Corps, both locally and nationally.

During the administrations of Theodore Roosevelt the idea of multiple-purpose planning for river

basin development began to gain currency. The U.S. Geological Survey and the Reclamation Bureau were in the forefront of this movement, while the Corps of Engineers, in part because of its conservative leadership and in part because it was constrained by the wishes of Congress rather than encouraged to pursue new ideas on its own, lagged behind in comprehensive planning throughout the early part of the twentieth century.

A number of waterways associations and other special interest groups responded affirmatively to the leadership of the Geological Survey and the Reclamation Bureau. These private interests saw hydroelectric power development as a means which would pay for the end they sought most fervently—the 14-foot channel from the Gulf of Mexico to the Great Lakes. Such a channel, deep enough to carry ocean-going vessels, was the subject of numerous meetings, one of the most important being the Deep Waterways Convention held in St. Louis in November 1906. The delegates to this meeting organized the Lakes-



—Missouri Historical Society

View of the St. Louis levee, 1905.

to-the-Gulf Deep Waterway Association to lobby for river development. By this time, however, the River and Harbor appropriations were less subject to political pressure than at any time in their history. In 1902 Congress had created a special Board of Engineers for Rivers and Harbors to approve or reject river development projects. The purpose of the Board was to remove appropriations from politics; although that goal was impossible, the board did serve as a restraining influence. In January 1907 it reported adversely on the project, and Congress refused to provide any money for deepening the Mississippi to 14 feet. The culmination of the multiple-purpose planning idea during the Roosevelt years came with the appointment in 1907 by T.R. of an Inland Waterways Commission. But the advocacy of multiple-purpose projects by the IWC failed to sway the Engineers, who continued to view navigation improvement as the primary goal of river development, and no major changes in Corps policy occurred.²

Although the Corps remained steadfast on these larger issues, the St. Louis District epitomized the inconstancy of the Corps regarding the best method of implementing navigation improvement and the irregularity of appropriations by the Congress. Virtually every year, the District Engineer complained bitterly about the failure of Congress to provide sufficient funds to prosecute the District's assigned work on the Mississippi. In fact, it was not uncommon for the District Engineer to report that the mission was actually further from completion at the end of the year than it had been at the beginning, because existing works were deteriorating and appropriations were not sufficient to maintain them. In 1901, Captain Edward Burr estimated that "the total loss of time by reason of the failure of appropriations will be at least two years."³

The very fact that twenty years after the project was begun to deepen and narrow the channel of the Mississippi the work was only 25 to 30% completed led to an experiment aimed at providing an 8-foot channel by dredging rather than by permanent improvements (contraction works and bank revetment). In December 1903, the recently-formed Board of



Engineer employees laying a lumber mattress revetment.



Mattress revetment was sunk into place by the use of large rocks, as shown in the picture.



Major Edward Burr
District Engineer, March 22, 1899-November 7, 1901.



Major Thomas L. Casey
District Engineer, November 7, 1901-August 6, 1906.

Engineers for Rivers and Harbors recommended that the St. Louis District attempt to secure and maintain an 8-foot channel by dredging, as was done on the Mississippi below Cairo. Interestingly, the one dissenter on the Board was the member with the most recent experience in the St. Louis District, Major Edward Burr (District Engineer, 1899-1901). He contended that the conditions which made permanent improvements on the lower Mississippi difficult did not exist on the middle Mississippi. In fact, the large amount of sediment dumped into the middle Mississippi by the Missouri made the conditions there virtually the converse of those on the lower Mississippi and therefore quite conducive to permanent improvement, while equally unfavorable to the possibility of maintaining a channel through dredging.⁴

Despite Major Burr's cogent and prophetic objections, the Board's recommendations were incorporated into the River and Harbor Act of 1905. Although hurdle work and revetments could still be used as auxiliary aids to navigation conditions, hence-

forth dredging was to be the primary means of maintaining the channel. Burr's successor at St. Louis, Major Thomas L. Casey, greeted the Board's recommendation with enthusiasm. He admitted that he had grave doubts about the feasibility of permanent improvements, given the effect of flood stages on hurdle work and other improvements in the past, and he suggested that if dredging did not succeed in revitalizing river commerce within ten years, then "it is but just to the taxpayers of the country that this particular improvement be suspended indefinitely." He went on to state that "the expenditure of public funds for the mere and solitary purpose of keeping railroad freight rates within satisfactory bounds, is, in my opinion, not a legitimate solution of that problem." Obviously, the outspoken Casey was a legitimate heir to Reynolds, Simpson, and Ernst!⁵

Dredging proved to be a limited success. By 1907 the minimum channel depth had increased from six to eight feet, and the River and Harbor Act of 1907 reaffirmed dependence upon dredging as the principal means of improvement. The construction of



Colonel Clinton B. Sears
District Engineer, August 9, 1906-January 27, 1908.



Captain Gustave R. Lukesh
District Engineer, January 28, 1908-September 30, 1908.

two new dredges was commissioned, and dredging (along with continued responsibility for snagging operations) absorbed most of the time and resources of the District.

As in any complex organization, however, matters of monumental unimportance required the attention of the highest officers. In response to an inquiry from Brigadier General Alexander Mackenzie, Lieutenant Colonel Clinton B. Sears (St. Louis District Engineer, 1906-1908) wrote that "Albert Bottum, Engineman, suspended September 7, 1906, has not been restored to duty. The cause of his removal... was for failing to report for duty at the proper time and for being intoxicated when he did report." Such mundane concerns were a far cry from Sears' army career as a youth. As a corporal in the Civil War prior to his West Point appointment, he had taken part in the Vicksburg campaign as regimental color bearer and in one assault "had his flagstaff shot in half between his hands and received six bullets through the flag in as many seconds." Obviously, the day-to-day life of the District Engineer was far more

pedestrian than a discussion of broad policy questions might suggest.⁶

But important policy issues were being decided during the period, and the views of Major Edward Burr were vindicated when, in 1909, Colonel William H. Bixby (who was serving concurrently as District Engineer, Division Engineer, and President of the Mississippi River Commission) reported that "the results of the dredging work ...show that the 1881 project, as revised by the 1903 Board, needs no further revision other than to add urgent recommendations for annual appropriations large enough to allow for the completion of the \$20,000,000 project within a reasonable term of years." This statement, although phrased in a misleading fashion, actually represented a complete reversal of the 1903 policy and a return to a primary emphasis upon permanent improvements as envisioned in the 1881 project. Dredging was once again relegated to an auxiliary role. Bixby found support in the March 20, 1909, report of the special Board on Examination and Survey of the Mississippi River from the Lakes to the



Colonel William H. Bixby
District Engineer, September 30, 1908-July 26, 1909; February 2, 1910-June 7, 1910; August 23, 1917-September 15, 1917.

Gulf, which recommended substantially a return to the 1881 project. These recommendations were adopted in the River and Harbor Act of 1910, which called for completion of the permanent improvements in twelve years. The estimated cost of completion was put at \$21,000,000. Thus the District would once again undertake permanent improvements on the Mississippi at such picturesque locales as Penitentiary Point, Dogtooth Bend, Hurricane Field, and Hanging Dog Island. Bixby's appointment as Chief of Engineers in 1910 virtually assured the resumption and continuation of the 1881 project.⁷

In addition to the more prosaic pursuits of river improvement, the District also had to cope with occasional emergencies. In 1910, ice gorges formed in early January and extended one hundred miles from the mouth of the Illinois to Kaskaskia. When the gorges became tightly packed, the water in St. Louis Harbor rose to 31.9 feet. "The gorges then broke and the ice swept out with the rapidly falling river, causing great damage by stranding and crushing to all the shipping in the harbor." The District not only lost

The Engineer fleet trapped in ice near Cairo Point, January 1912.



—Missouri Historical Society

Ice on the Mississippi periodically stopped navigation altogether. In 1905, an ice gorge allowed St. Louisans to walk across the river.



Piling dike or hurdle being constructed.

some of its floating plant, but also had to repair damaged regulating works in the harbor.⁸

In 1912, and again in 1913, the District loaned men and equipment to aid in relief of flood victims on the lower Mississippi. In 1912, three steam towboats were dispatched to distribute provisions, tents, bedding, and feed to flood victims. In addition, about 550 men, women, and children were rescued by the towboats, along with 850 head of stock. The following year, two towboats from the St. Louis District rescued 2600 people and 300 head of stock. These floods had little impact on St. Louis, although the southernmost part of the District suffered some damage.⁹

During the years 1913-1915, the District adopted

new techniques and machinery aimed at both increasing efficiency in constructing regulating works and assuring the efficacy of completed works. Utilizing the best technology of the day, the District had constructed four new steam-hammer pile drivers and two combined hydraulic graders and derricks for bank revetment work. The latter were equipped with powerful electric searchlights and arc lights for night work. At about the same time, just south of the St. Louis District, Major C. O. Sherrill was experimenting with the use of concrete in levees, which, together with other improvement works, opened a new technological era in channel modification and regulating works.¹⁰



—Missouri Historical Society

Coal barges of the type used in the early 1900s.



—Missouri Historical Society

Typical lumber barge used in the early 1900s.



Lieutenant Clarence H. Knight
District Engineer, July 27, 1909 February 2, 1910; June 8,
1910-August 22, 1910.



Lieutenant Colonel Charles L. Potter.
District Engineer, August 23, 1910-July 31, 1912.

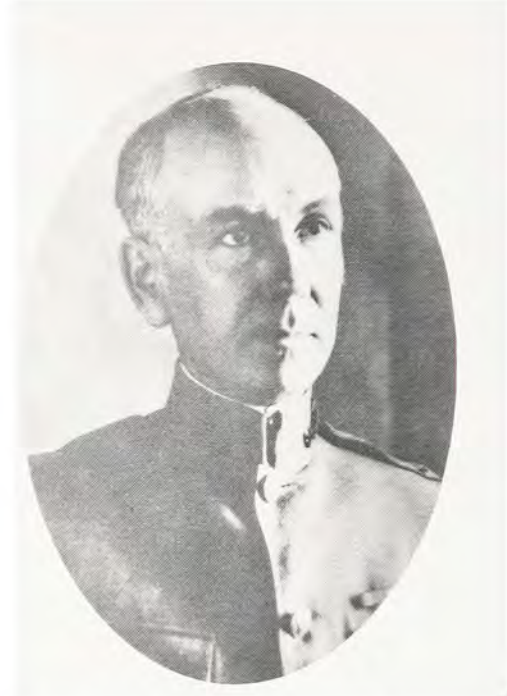
Meanwhile, river commerce at St. Louis remained constant, although nowhere near the levels of the nineteenth century. From 1912 to 1917, the value of river commerce fluctuated from \$11 to \$15 million; then, in 1918, the value of products jumped to \$18 million. This increase was a direct result of the great pressure placed on transportation systems by American participation in World War I. When the railroads and the infant trucking industry proved inadequate to meet these increased demands, river traffic revived. Congress created a federal barge line between St. Louis and New Orleans—the Mississippi-Warrior River line—and spent some \$8,000,000 for equipment “in restoring the Mississippi to the status of a great freight-carrying waterway.” The venture proved so successful that the barge line was continued after the war and was actually turning a profit by 1921.¹¹

With the stimulus provided by this line, St. Louis

river commerce increased dramatically; its value jumped to \$22.6 million in 1919, \$30.8 million in 1920, and \$47.4 million in 1921. Obviously, the work of the St. Louis District had once again assumed a crucial role in the commercial life of the area. But Congress continued to provide only minimal funds for the middle Mississippi, leading Major Dewitt C. Jones to complain that “because of the small and insufficient appropriations for this district in recent years, the regulation works have deteriorated rapidly and many sections thereof have been entirely destroyed.” He went on to point out that the river was again becoming excessively wide, a mile or more in places. Furthermore, the longer Congress waited, the more expensive completion of permanent improvements would become; in 1921, Jones estimated that the cost had increased from the original estimate of \$20 million to somewhere between \$25 and \$30 million.¹²



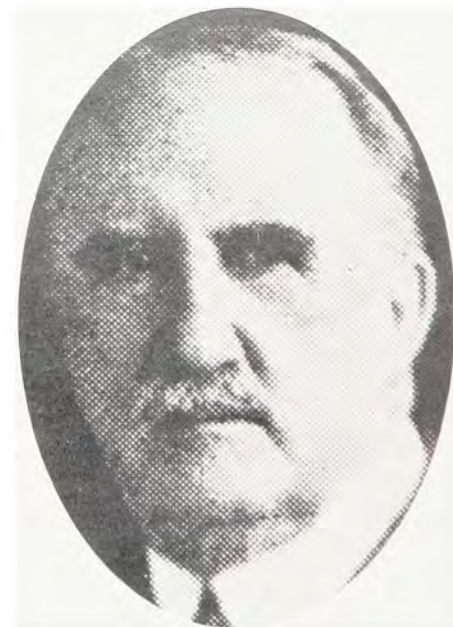
Colonel Curtis McDonald Townsend
District Engineer, August 1, 1912—June 14, 1915.



Lieutenant Colonel Clarke S. Smith
District Engineer, June 7, 1917-August 23, 1917.



Colonel Wildurr Willing
District Engineer, June 15, 1915—June 6, 1917; February 2, 1919-May 31, 1920.



William S. Mitchell
District Engineer, September 15, 1917-February 1, 1919.



Major DeWitt C. Jones
District Engineer, June 1, 1920-August 23, 1922.



Major John C. Gotwals
District Engineer, May 5, 1924-July 19, 1930.



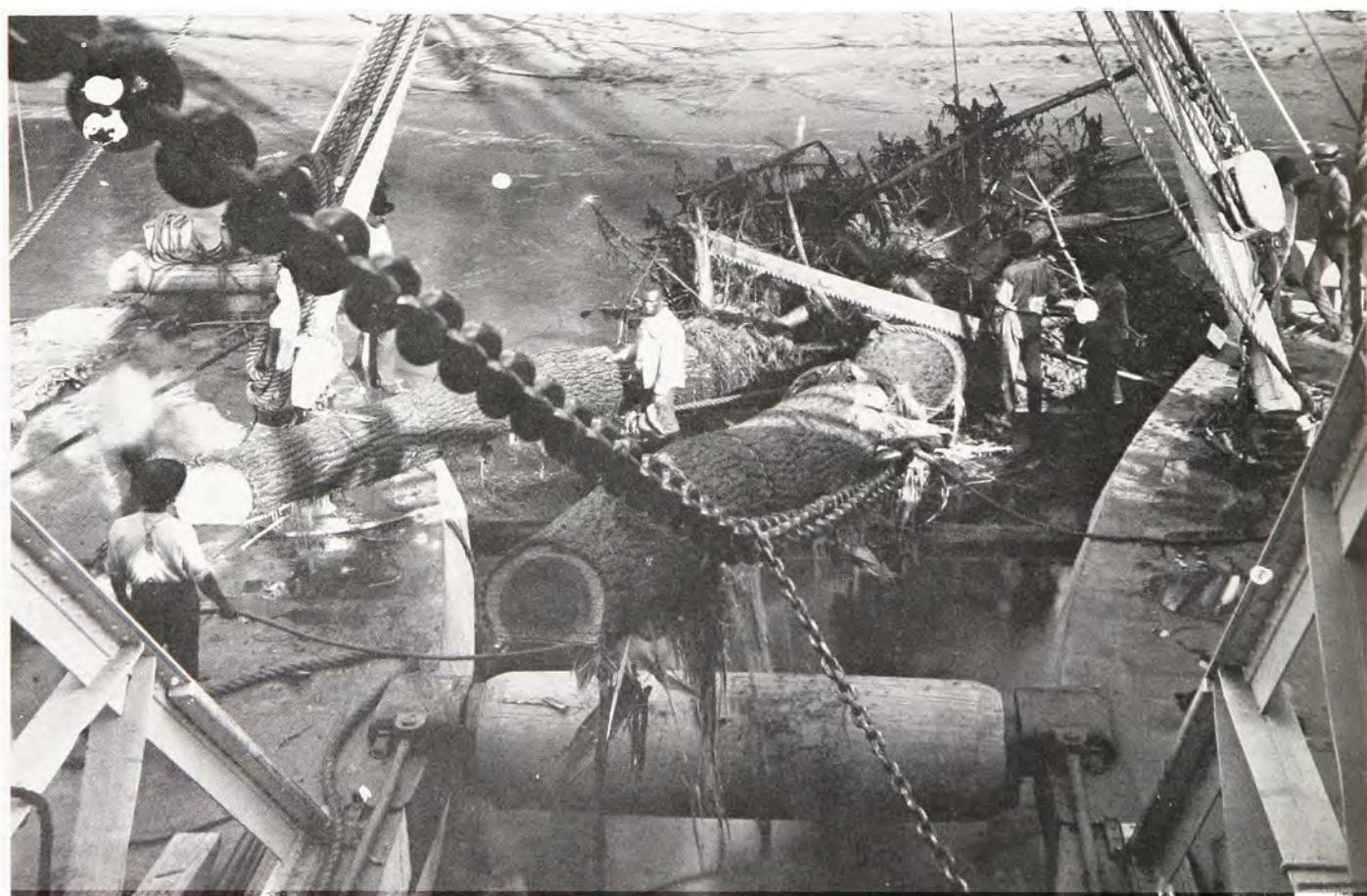
Major Lunsford E. Oliver
District Engineer, August 24, 1922-May 5, 1924.

The navigation improvement mission of the District was altered once again by the River and Harbor Act of 1927, which provided for a depth of 9 feet and a width of 300 feet from the Ohio River to the northern boundary of St. Louis. The following year the Chief of Engineers recommended modification of the project above St. Louis to provide for a channel 9 feet deep and 200 feet wide; at the same time the stretch of the river from the mouth of the Missouri to the mouth of the Illinois was once again placed in the charge of the St. Louis District. The recommended new dimensions for that stretch were adopted in the River and Harbor Act of 1930. Also in 1928, District Engineer Major John C. Gotwals reported that the increased traffic on the Mississippi required the full project dimensions, since most loaded barges were found to have a draft of eight to nine feet. The boundaries of the District were further extended in 1930 to include the Missouri River to Hermann, Missouri (about 104 miles from the mouth).¹³



—Missouri Historical Society

Engineer Snagboat *Horatio G. Wright* (1880-1941).



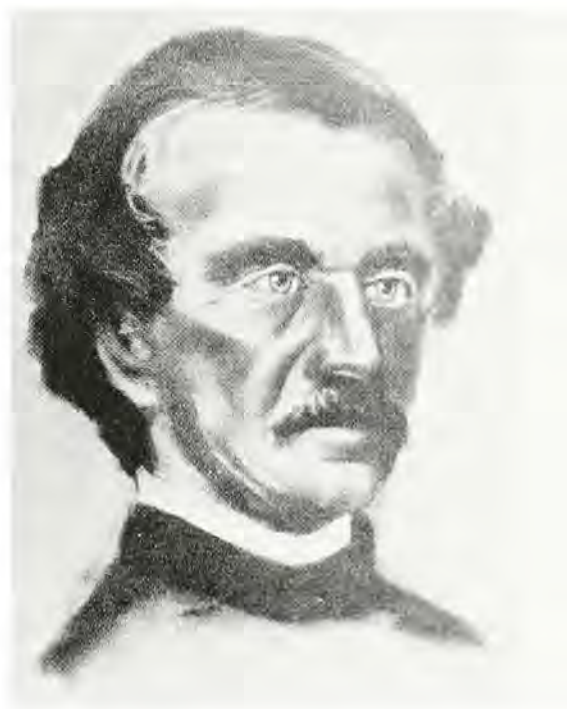
Twin snags drawn onto the butting beam of a snagboat for sawing.

Because Congress had begun to appropriate larger sums with greater regularity since 1924, the regulation works on the middle Mississippi were 57% complete by 1930. The impact of these improvements was reflected in the greatly increased traffic on the Mississippi. Both the tonnage and value of shipments doubled between 1924 and 1928. If shippers felt that river traffic could be relied on because depths had been regularized and obstructions removed, then obviously they would use river transportation (freight rates by water were generally 80% of rail rates). The regulating works, combined with the continued snagging operations of the St. Louis District, assured safe and reliable river commerce; it was the work of the Engineers, combined with the appearance of the federal barge line, that was responsible for the rejuvenation of the Mississippi as an important artery of commerce.¹⁴

The primary mission of the Engineers in St. Louis was therefore nearing realization; navigation conditions had been improved and regularized to a point where river commerce was safe and dependable. But even though navigation improvement had been the main concern of the St. Louis District since its inception (and of individual engineers like Lee before that), pressures had been building for a number of years for the Engineers to take a hand in flood control. The periodic inundations of the Mississippi Valley underscored the necessity for some sort of action; as the Valley became more heavily populated, the potential for disaster increased with each new flood.

Congress was reluctant to make flood control a federal responsibility, but early recognized the need for some kind of federal action. Thus in 1849 Congress had enacted the first legislation containing direct federal aid for flood control; the aid took the form of limited land grants to Louisiana in 1849, and to other affected states in 1850. The purpose of the land grants was to vest ownership in the states of lands subject to overflow. In practice, this system was ineffectual.¹⁵

Also in 1850, Congress commissioned "a topographical and hydrographical survey of the delta of



Major General Andrew A. Humphreys
Chief Engineer, 1866-1879.

the Mississippi with such investigations as may lead to determine the most practical plan for securing it from inundation." Two studies were undertaken simultaneously—one by Charles S. Ellet, Jr., a leading civil engineer, and one by Topographical Engineers Colonel Stephen H. Long and Captain Andrew A. Humphreys. Humphreys' illness prevented prompt completion of their study, so Ellet's report was completed first, on October 31, 1851. He concluded that floods in the Mississippi Valley were increasing in height because levees confined the waters, forcing them to flow faster and rise higher in order to discharge the same volume. Settlers were occupying areas which formerly had served as natural overflow reservoirs for the Mississippi. As that happened, pressure for more and higher levees increased, confinement of the river escalated, and flood heights grew. To aggravate the problem further, farmers upstream were destroying the natural ground coverings and consequently accelerating the drainage of surface water into the Mississippi and its tributaries.¹⁶

Although he considered levees responsible for the problem, Ellet assumed that the process could not be reversed. As a result, he argued for stronger and higher levees. But he proposed to amend the existing system by providing for artificial outlets to relieve some of the pressure on the levees and to reduce the discharge carried by the river. Both of these suggestions would eventually be implemented, but Ellet felt that these approaches alone were inadequate to prevent serious floods in the lower Mississippi Valley. Therefore, he recommended the creation of artificial reservoirs on tributary streams in order to control discharge into the Mississippi. This suggestion, like the levees and outlets ideas, although "based on scanty hydrographical data," was prophetic of future directions in flood control policy. But Ellet's plan for reservoirs was not implemented. Not until 1928 would a comparably comprehensive flood control plan be published by the Government. Ellet was obviously far ahead of his time—too far ahead, it turned out, to be taken seriously.¹⁷

The next report to appear on the question of flood control on the Mississippi was produced by two officers of the Corps of Topographical Engineers and would establish the parameters of Corps' thinking on the flood control question for several decades to come. Published in 1861, the report by Captain Andrew A. Humphreys and Lieutenant Henry L. Abbot rejected the ideas of reservoirs and emergency outlets or cutoffs; instead it endorsed the levee system as adequate to protect the Mississippi Valley from floods. Humphreys and Abbot also concluded that the federal government should aid in flood control.¹⁸

An important first step toward providing a comprehensive program of river development and flood control was the creation of the Mississippi River Commission in 1879. Its assigned functions included making surveys, plans, and estimates for improvements to "correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River, improve and give safety and ease to the navigation thereof; prevent destructive floods; promote and facilitate commerce, trade, and the postal service" (these duties would later be expanded). The

Commission was to be composed of seven members—three from the Corps of Engineers, one from the Coast and Geodetic Survey, and three from civilian life. The President of the Commission was to be one of the representatives from the Corps of Engineers. This marked the first formal involvement of the Corps in the field of flood control. But the involvement was only at the level of planning; the Mississippi River Commission was initially prohibited from expending funds to protect lands from floods. However, in large part because of the flood of 1882, the Mississippi River Commission was soon given responsibility for construction of levees (to improve navigation) below Cairo. Although the Mississippi River Commission was in charge of surveying the entire river, its responsibility for improvements extended from the Head of the Passes only as far north as Cairo.¹⁹

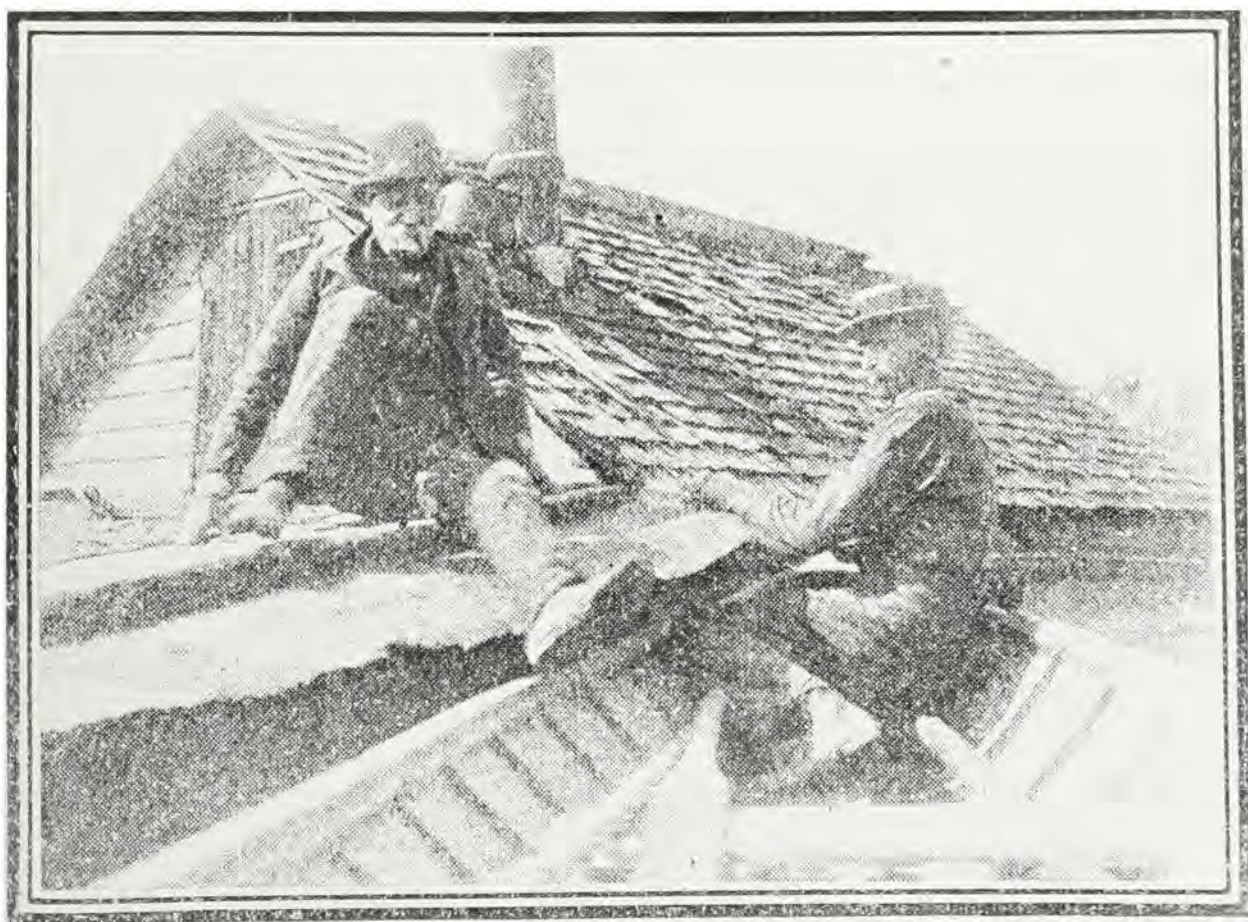
The 1903 flood was especially devastating to East St. Louis. Shown here are locomotives and cars caught in a sudden rise caused by a break in the levee. From *Review of Reviews* (July 1903).



Extension of Mississippi River Commission levee authority into the St. Louis District began with the River and Harbor Act of 1913, which provided for an examination of the Mississippi between Cape Girardeau, Missouri, and Rock Island, Illinois, "with a view to such improvements as will at the same time promote navigation, develop water power, and protect property adjacent to said river from damages by floods...and for the building of such levees between said points upon the river in aid of navigation, as may be found necessary or desirable by the Commission and approved by the Chief of Engineers." That examination resulted in provisions in the River and Harbor Act of 1916 and the Flood Control Acts of 1917

and 1923 which established the construction of levees for flood control between the mouth of the Ohio River and Rock Island, Illinois, as the responsibility of the Mississippi River Commission.²⁰

The use of levees only for flood control—the "confinement theory"—dated back to the Humphreys-Abbot report of 1861 and early Mississippi River Commission interpretations thereof, but it also had able defenders in the early decades of the twentieth century. The foremost spokesman for the confinement theory was Colonel Curtis McDonald Townsend, who was concurrently President of the Mississippi River Commission and District Engineer in St. Louis (1912-1915).



Rescuing a flood victim in East St. Louis, from *Review of Reviews* (July 1903).

NOTICE.

All Citizens able to accomodate

REFUGEES

from EAST ST. LOUIS are requested to report to the Relief Committee at (Office of Geo. C. Rebhan.)

☛ RELIEF COMMITTEE.

Proclamation !

EAST ST. LOUIS, ILL.,
June 8th, 1903.

All business is ordered suspended to-day, and every male citizen of East St. Louis, is hereby requested to render service in keeping the water out of city.

SILAS COOK.



Mayor.

Townsend had early in life proved his persistence and courage—traits which would serve him well in the battle over flood control. In one of his first Corps assignments, as District Engineer in Memphis, he contracted typhoid fever and became critically ill; “he overheard the doctor tell his father ‘we’ll carry him out in the morning.’” His response was something along the line of “over my dead body”; he fought back from his illness and proceeded to become one of the most important Corps figures in the first quarter of the twentieth century.

Townsend wrote several papers in 1912 and 1913 which were “masterly expositions of the hydraulics of the Mississippi River.” Although he agreed that levees increased flood heights, he did not believe that such an increase was a sufficient reason for abandoning levee construction. In fact, he found no suitable alternative to levees, rejecting in turn proposals for reservoirs, reforestation, parallel channels, outlets, and cutoffs. During the crucial 1912-1917 period, Townsend was probably the most persuasive advocate for the confinement theory, which was ultimately adopted in the first Flood Control Act in 1917.²¹

The only other possible solution to the flood problem that received any favorable response from the Corps of Engineers was the idea of floodplain management. The Board of Officers on River Floods reported that “damage by floods might also be largely prevented by another method not involving control of the flood itself by moving valuable property beyond the flood limits.” The Board members inspected the destruction caused by the floods of 1913 and found that “in every case a large percentage of the damage suffered was due to the fact that people had knowingly erected buildings and lived in territory which has always been subject to inundation by high water.” Since it was not feasible, however, to force people out of the flood plains, the levees policy ultimately received the Corps’ endorsement.²²

Major flooding on the Mississippi in 1912, 1913, and 1916 led to passage of the Flood Control Act of 1917, which committed the federal government “legally to assume major responsibility for the control of floods” for the first time. The act appropriated \$45,000,000

for flood control work in the lower Mississippi River Basin (to be expended by the Mississippi River Commission), as well as \$5,600,000 for flood control on the Sacramento River. This act marked the first time the federal government had gone into levee building "frankly as a measure of flood control." Furthermore, the act placed flood control on an equal footing with navigation improvement among the civil functions of the Corps of Engineers. The Flood Control Act of 1923 extended the jurisdiction of the Mississippi River Commission to include flood control on all tributaries which affected the stages of the Mississippi. The River and Harbor Act of 1925 also included provisions for flood control.²³

Then, in 1927, catastrophic floods on the Mississippi "vividly proved that levees were inadequate to prevent general flooding." The flooding was the greatest in recorded history. Over 700,000 people were forced to flee their homes; 246 people and 165,000 head of livestock drowned. Property damage exceeded \$364,000,000. Clearly the levee system had proved inadequate to the task of coping with such a volume of water. Yet it was not a total failure; in almost every case, the levees held the flood waters back long enough to permit rescue of the inhabitants of the flood plains. Nevertheless, the flood forced a realization that, as the *St. Louis Post-Dispatch* put it, "levees are important, will always be indispensable, but they

The flood of 1927 was one of the most destructive in history, as these scenes illustrate



are not enough." The St. Louis District escaped the brunt of the great flood, but ten counties in the District were affected (four in Missouri, six in Illinois) and the Red Cross established eighteen refugee camps in the two states which cared for 8,392 people. It was the worst flood in the District since 1903, when East St. Louis and the towns opposite the mouth of the Missouri were inundated.²⁴

The governmental response to the 1927 flood disaster was embodied in the Reid-Jones Flood Control Bill of 1928. This plan was designed to control a flood 25 percent greater than the flood of 1927. It provided for auxiliary floodways which "would re-

lieve the main channel of the water it could not carry and lower the floods to stages at which the levees could contain them"; a controlled spillway near New Orleans; and strengthening of levees. This plan had been developed by Major General Edgar Jadwin, Chief of Engineers. The Jadwin plan was "designed to restore *during great floods only* the width of channel that the levee system had cost the river." But perhaps the most dramatic change wrought by the act was in the area of financing flood control—for the first time, the act stated that "no local contribution to the project herein adopted is required." The acceptance of financial responsibil-



The results of an effective hurdle or piling dike is an accumulation of drift above the hurdle and a deposit of sand below.



— *Missouri Historical Society*

The St. Louis Levee in 1928.

ity by the federal government marked a new epoch in flood control. Equally portentous for the future was a provision in the act for flood control surveys of all tributaries of the Mississippi, including the possible use of reservoirs. Furthermore, the act provided for the establishment of a hydraulics laboratory at Vicksburg, so that future policy could be based on scientific information rather than recalled experience and unsystematic observation. Such actions had obvious beneficial implications for the St. Louis District.²⁵

This concern with flood control was indicative of a larger trend toward multiple purpose water resource development. By the end of the Theodore Roosevelt administration, the concept of multipurpose planning was no closer to fruition than at the beginning. But it was an idea whose time was near and by 1930 the nation would have taken long strides toward true multipurpose planning. A first step was taken in 1909, when the River and Harbor Act required considera-

tion of hydroelectric power development in all subsequent river improvement projects. Even more far-reaching was the Flood Control Act of 1917, which required flood control surveys of the Mississippi to include a comprehensive watershed study and consideration of all other possibilities for related water use.²⁶

But it was the River and Harbor Act of 1925 which was "one of the principal landmarks in the evolution of the Corps of Engineers' civil functions." Section 3 of that act directed the Corps of Engineers and the Federal Power Commission jointly to survey and submit reports on all navigable streams, except the Colorado, indicating what possibilities existed for navigation, power, flood control, and irrigation—in other words, multiple purpose water resources development. On April 12, 1926, the Secretary of War submitted *House Document No. 308* to Congress, presenting an estimate of cost of surveys and reports on about 200 rivers. The River and Harbor Act of 1927



—Missouri Historical Society

Steamboat *Alton*, a combination packet and excursion boat involved in the St. Louis-Alton trade.

authorized the surveys, and multipurpose planning became a reality. The resulting "308 Reports" embodied the first systematic efforts at comprehensive basin development planning. Most of the reports (191) were complete within the following decade, and served as the foundation for subsequent river basin development.²⁷

Thus, by 1930 the civil works program of the Corps of Engineers had evolved from a narrow, single-purpose, single-project approach to "planning, design, construction, operation, and maintenance of multiple-purpose basin-wide integrated developments for optimum beneficial uses of the river systems of the entire United States." The St. Louis District during the years 1900-1930 had moved from being a virtually autonomous district concerned with local problems and with the solitary mission of navigation improvement to being an integrated part of larger national water resources planning. As local issues became more and more subordinate to national concerns and as the federal government assumed an ever-larger

role in water resources development, the plans and activities of the District became inextricably intertwined with national policies. To a large extent, then, the history of the St. Louis District in the modern period would be a microcosm of the changing role and expanding mission of the Corps of Engineers at the national level.²⁸

But the impact of national events was not limited to water resources policies; economic conditions, always an important consideration, acquired a new significance by the end of this period. As the prosperous glow of the twenties gave way to the bleak pall of depression, the Corps would assume a new role both locally and nationally as employer of the jobless and as economic stimulus for an undernourished economy. The Corps of Engineers in general and the St. Louis District in particular had achieved a great deal by 1930; they had a long and proud history of service in behalf of both national and local interests. But the thirties would not be a time for resting on the laurels of past achievements. The biggest tasks were yet to come.

CABIN PASSENGER TARIFF

-Between-
ST. LOUIS, MO., and
PRIAR'S POINT, MISS.
Including Meals and Berth.
Effective March 1st, 1902

Crystal City, Mo.	---\$1.00	Tiptonville, Tenn.	---\$6.50
Ste. Genevieve, Mo.	1.50	Cherokee, Tenn.	6.50
Chester, Ills.	2.00	Stewarts, Mo.	6.50
Claryville, Mo.	2.00	Avenue, Mo.	6.50
Wagners, Ills.	2.25	Reelfoot, Tenn.	6.50
Red Rock, Mo.	2.50	Hathaways, Tenn.	6.50
Wittenberg, Mo.	2.50	Gayoso, Mo.	6.75
Grand Tower, Ills.	2.50	Caruthersville, Mo.	7.00
Neelys, Mo.	3.50	Booths Point, Tenn.	7.25
Cape Girardeau, Mo.	3.50	Cottonwood P't., Mo.	7.25
Thebes, Ills.	3.50	Tyler, Mo.	7.30

—Missouri Historical Society

Typical passenger rates for steamboats on the Mississippi in the early 20th century.



—Missouri Historical Society

Passenger cabin of the *Alton*.

Footnotes Chapter 4

1. Franklin Matthews, "St. Louis: Most American of Cities," *Harper's Weekly* 45 (September 14, 1901), 917-31; William Flewellyn Saunders, "St. Louis—A Strong Western City," *Review of Reviews* 27 (May 1903), 557-64; Dena Lange, *A History of St. Louis* (St. Louis, 1930); Robert I. Vexler, ed., *St. Louis: A Chronological and Documentary History, 1762-1970* (Dobbs Ferry, New York, 1974), 57.
2. Samuel P. Hays, *Conservation and the Gospel of Efficiency* (Cambridge, Mass., 1959), 95-121; John R. Ferrell, "Water Resources Development: The Role of the Army Engineers, 1824-1930," (unpublished manuscript, Office of the Chief of Engineers, Historical Division), chapter 3; Edward L. Pross, "A History of Rivers and Harbors Appropriation Bills, 1866-1933," (unpublished Ph.D. dissertation, Ohio State University, 1938), 120. The Chicago Sanitary District promoted the hydropower aspect, although its real interest in the channel was as a way to carry the runoff from Lake Michigan which had been diverted by the Drainage Canal.
3. *Annual Report of the Chief of Engineers, 1900*, 426-27; *Annual Report, 1901*, 436; *Annual Report, 1902*, 1598.
4. *Annual Report, 1904*, 2144-50.
5. *Annual Report, 1905*, 424, 1588-92.
6. *Annual Report, 1907*, 812-13; Lt. Col. Clinton B. Sears to Brig. General A. Mackenzie, December 6, 1906, National Archives Record Group 77; "Clinton B. Sears," *Annual Reunion* (June 11, 1912), 1201. Snagging operations were still a major responsibility of the St. Louis District, but the method remained substantially as described in the previous chapters. See George H. Dacy, "Pulling the Mississippi's Teeth: What Is Being Done By Way of Making Our Longest River Navigable," *Scientific American* 125 (July 23, 1921), 60-61.
7. *Annual Report, 1909*, 551; *Annual Report, 1910*, 1756; *Annual Report, 1908* 1615; "William H. Bixby," *Annual Report* (West Point Alumni Magazine, June 12, 1929), 91-93.
8. *Annual Report, 1910*, 1762.
9. *Annual Report, 1912*, 2113; *Annual Report, 1913*, 2363, 2375.
10. *Annual Report, 1914*, 2626; "Concrete to Balk Mississippi Floods," *Literary Digest* 49 (November 7, 1914), 884-85. In 1925, the District began experimenting with concrete dike ends. *Annual Report, 1926*, 1030.
11. *Annual Report, 1917*, 1118; *Annual Report, 1918*, 1158; *Annual Report, 1919*, 1226; George F. Paul, "Drafting" the Mississippi to Win the War," *Illustrated World* 30 (December 1918), 634; "A Barge Line on the Mississippi that is Making Money," *Current Opinion* 72 (April 1922), 544; "A Revival of Traffic on the Mississippi," *World's Work* 51 (January 1926), 242-43. See also Edwin A. Leland, Jr., "An Administrative History of the Inland Waterways Corporation," (unpublished Ph.D. dissertation, Tulane University, 1960).
12. *Annual Report, 1921*, 1198-1202; DeWitt C. Jones and James W. Skelly, "Regulation of Middle Mississippi River," *The Military Engineer* 13 (1921), 197-204, 272-74. There was also a large jump in tonnage shipped from St. Louis between 1921 and 1922, but the increase was largely in the shipment of garbage downriver. *Annual Report, 1923*, 1083.
13. *Annual Report, 1927*, 1052, 1104; *Annual Report, 1929*, 1102; *Annual Report, 1930*, 1190, 1231.
14. *Annual Report, 1922*, 1223; *Annual Report, 1929*, 1107; *Annual Report, 1930*, 1199.
15. Ferrell, "Water Resources," chapter 1; Arthur D. Frank, *The Development of the Federal Power of Flood Control on the Mississippi River* (New York, 1930).
16. 9 *Statutes at Large* 523, 539; Ferrell, "Water Resources," chapter 1; Frank, *Federal Power*, 25; Charles Ellet, *The Mississippi and Ohio Rivers* (Philadelphia, 1853).
17. Ferrell, "Water Resources," chapter 1.
18. A. A. Humphreys and H. L. Abbot, *Report Upon the Physics and Hydraulics of the Mississippi River* (Washington, 1861); Ferrell, "Water Resources," chapter 1.
19. 21 *Statutes at Large* 37-38; W. Stull Holt, *The Office of the Chief of Engineers of the Army: Its Non-military History, Activities, and Organization* (Baltimore, 1923), 74-75; Office of the Chief of Engineers, *U.S. Army Corps of Engineers: The Contribution of Its Civil Works to National Preparedness* (Washington, 1964); Ferrell, "Water Resources," chapter 2.
20. *Annual Report, 1923*, 1869-73. The Mississippi River Commission had been headquartered in St. Louis since its formation, and it was not unusual for the St. Louis District Engineer to be a member of the commission, or even its president.
21. Ferrell, "Water Resources," chapter 4; "Curtis McDonald Townsend," *Assembly* (January 1943), 5; Hays, *Conservation and Gospel of Efficiency*, 206-10; Albert E. Cowdrey, *The Delta Engineers* (New Orleans, 1971), 27-29.
22. Ferrell, "Water Resources," chapter 4.
23. Frank Smith, *Land and Water, 1900-1970* (New York, 1971), 281-85; 39 *Statutes at Large* 948-51; John Furman Wall, "The Civil Works of the United States Army Corps of Engineers: Program Modernization" (unpublished Ph.D. dissertation, Cornell University, 1973), B26-27; Frank, *Development of Federal Power*, 143; Ferrell, "Water Resources," chapters 4, 5.
24. Ferrell, "Water Resources," chapter 6; American National Red Cross, *The Mississippi Valley Flood Disaster of 1927: Official Report of the Relief Operations* (Washington, 1929), 39, 54; "Congress and Mississippi Flood Control," *Congressional Digest* 7 (February 1928), 41-54; Charles Moreau Harger, "The Recent Floods of the Middle West," *Review of Reviews* 28 (July 1903), 77-78.
- 45 *Statutes at Large* 534-39; Ferrell, "Water Resources," chapter 6; Frank, *Development of Federal Power*, 221; Cowdrey, *Delta Engineers*, 33-34; Wall, "Civil Works," 161, B27.
26. Wall, "Civil Works," B20; 35 *Statutes at Large* 815; 39 *Statutes at Large* 948-50.
27. Ferrell, "Water Resources," chapter 6; James S. Bowman, "Multipurpose River Developments," *Transactions, American Society of Civil Engineers* 100 (1953), 1127; C. H. Chorpeneing, "Waterway Growth in the United States," *ibid.*, 1004; Wall, "Civil Works," B22; 43 *Statutes at Large* 1190; 44 *Statutes at Large* 1010.
28. Ferrell, "Water Resources," chapter 6.



The Mississippi, 1935, a painting by John Steuart Curry.

The District as An Instrument of National Policy: The Depression and World War II

"No help wanted." That sign of the times was posted widely throughout Depression-era St. Louis, and it burned itself into the consciousness of thousands of unemployed workers as the local economy followed the national economy in its downward plunge. The parallel between the local and national economies was not absolute—St. Louis did not suffer as great an economic decline as most other large cities or as the nation as a whole during the early thirties, in part because the city had not participated fully in the boom of the twenties and in part because of the area's widely-diversified industrial base. But that fact was undoubtedly of small comfort to the more than 50,000 St. Louis workers without jobs. Nor could it have had much meaning for the 1000 plus souls who were residents of the nation's largest "Hooverville"—a collection of crude shacks, shanties, and shelters thrown together with old packing crates, automobile bodies, scrap metal, and anything else that was available. St. Louis had a number of Hoovervilles scattered throughout the city; the biggest one was located on the riverfront just south of the Free (MacArthur) Bridge. Although St. Louis might have suffered less than some cities, it was by no means exempt from the Depression.¹

—*St. Louis Art Museum*



—Missouri Historical Society

An unemployment parade at 12th and Market, June 8, 1932.



— Archives and Manuscripts;
University of Missouri-St. Louis

The Hooverville on the riverfront did not fare well in times of high water.



— Archives and Manuscripts;
University of Missouri-St. Louis

The Hooverville on the levee, with the MacArthur bridge in the background.

For those families which still had some means of support, it was possible to get by; in some cases, prices actually dropped faster than wages. But there were millions of Americans who were literally destitute. Their plight was appalling. According to historian William Leuchtenburg, "in the St. Louis dumps, small groups of men, women, and children dug for rotten food." Relief for the poor was inadequate from the beginning, and it got progressively worse. Ultimately, St. Louis removed half the relief families from its rolls. Private charities exhausted their resources. If local governments and private philanthropies could not carry the load, as was becoming patently obvious, then the federal government would have to step in. What was needed was some way to put people back to work.²



—Archives and Manuscripts:
University of Missouri-St. Louis

Hooverville resident in front of his home.



Captain Sylvester E. Nortner
District Engineer, July 19, 1930-November 4, 1930.



Major William A. Snow
District Engineer, November 4, 1930-December 1, 1933.

The inauguration of Franklin D. Roosevelt in 1933 marked the advent of a new social philosophy which accepted the federal government's responsibility to do just that. Legislation was enacted in response to Roosevelt's urging which would pump billions of dollars into public works projects and give jobs and hope to millions of destitute Americans. The first large scale effort was embodied in the National Industrial Recovery Act in 1933, which established the Public Works Administration and gave it over \$3 billion for major public works projects. PWA was followed by CWA (Civil Works Administration) and WPA (Works Progress Administration), as well as a welter of other "alphabet agencies." These agencies spent billions of dollars for new jobs. Sometimes the jobs were of the "leaf-raking" or make-work variety. Critics giped that WPA stood for "We Poke Along." But both the PWA and WPA were anxious to fund worthwhile projects if they could be found. Here, the Corps of Engineers came into the picture.³

According to one Corps officer, "immediate and full participation of the Corps of Engineers was made

possible by the prepared 'backlog' of meritorious river and harbor projects which the Corps had ready for immediate execution." In late September 1933, the St. Louis District Engineer, Major William A. Snow, was notified that PWA funds had been allocated to the District for river construction works. Within a month of notification, the first work using PWA funds was begun. In 1935 the Emergency Relief Appropriation Act—"the greatest single appropriation in the history of the United States or any other nation" up to that time—provided funds for the WPA, which in turned allocated construction funds to the St. Louis District. PWA and WPA funds were used not only for dike and revetment construction but also for bank clearing and for lock and dam construction (Lock No. 25 would use WPA funds, Lock and Dam No. 26 would use PWA funds). These projects produced beneficial, long-term results—they were not just make-work.⁴

There were problems in using the Corps as a relief work agency, however: the work was intermittent because of changing river conditions; the work was sometimes a considerable distance from the labor sup-



Major Bartley M. Harloe
District Engineer, December 1, 1933-July 22, 1935.

ply; and work conditions were sometimes hazardous, especially for the inexperienced. But despite these problems, by April 1936 the St. Louis District had spent \$12.3 million of emergency funds, resulting in six million man hours of employment. There was an unexpended balance of \$8 million as of April which was expected to generate another four million man hours. These projects in the St. Louis District which had already been planned and were ready for execution proved a propitious way of combating unemployment and alleviating suffering in Missouri and Illinois during the dismal days of the Depression.⁵

The rationale for these District projects continued to be based on the national importance of navigation and commerce on the Mississippi River. Although river commerce in the District declined in the early thirties in reaction to generally grave economic conditions, by 1938 St. Louis traffic had almost equalled the tonnage of 1928. Even more significant nationally than the tonnage was the changing character of the cargoes; petroleum products and crude oil were becoming an increasingly important part of river

commerce during this period. Improvement in navigation conditions would be essential, however, if river commerce on the middle Mississippi was to realize its full potential. By a strange twist of irony, the national catastrophe of the Depression would create the conditions—substantial government appropriations and available manpower—that would make those improvements possible.⁶

The most significant navigation work of the District during the decade of the thirties was done on a section of the Mississippi which had only recently come under St. Louis's jurisdiction. In 1928 the northern boundary of the District had been extended from the mouth of the Missouri River up the Mississippi to the mouth of the Illinois River. Five years later the boundary was pushed northward to Clarksville, Missouri, making the District responsible for 300 miles of the Mississippi River. Thus the District for the first time now extended beyond the middle Mississippi into the upper Mississippi. This change was especially important in the light of contemporary river and harbor legislation. The 1927 River and Harbor Act had authorized a survey of the Mississippi between St. Louis and Minneapolis with a view to securing a nine-foot channel. Subsequent to the survey, the River and Harbor Act of 1930 authorized the nine-foot project.⁷

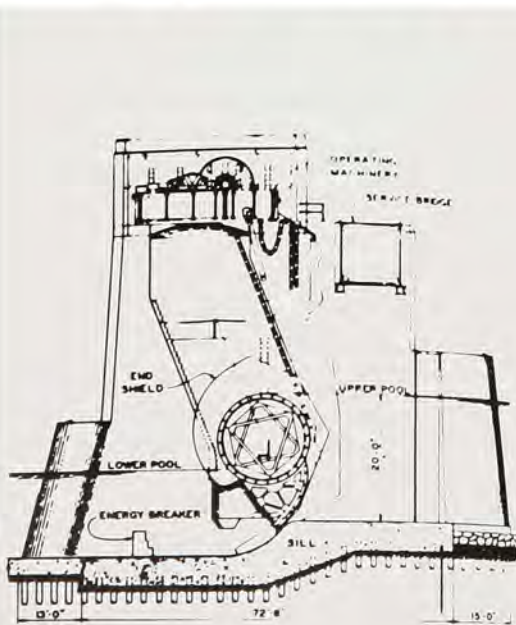
The nine-foot channel was recommended in order to make possible economical river transportation on the upper Mississippi. That section of the Mississippi had traditionally offered very uncertain navigation conditions. A six-foot channel had been authorized in 1907, but the method used in attempting to achieve the six-foot depth was open river regulation like that used on the middle and lower Mississippi; this method proved to be ill-suited to conditions on the upper Mississippi. Yet even if the six-foot channel could have been achieved and maintained (it could not), according to a special Board of Engineers, "the present 6-foot project and the methods of prosecuting it were designed to aid types of river trade which have become obsolete," such as log rafts and packet boats carrying high-class freight. Contemporary economic

conditions, however, demanded operation on a large scale if river service was to be successful. Since four feet was the greatest depth that could be guaranteed under the "six-foot" project during low water, only tows and barges with a four-foot draft could be used on the upper river. This meant that shipments going upriver past St. Louis had to be transferred at St. Louis from the larger barges used on the lower river to shallow-draft barges. The opposite situation existed for traffic coming downriver. Such transshipment greatly increased the cost of river transportation and made it virtually impossible for barge lines to compete with railroads. As a result, the farmers of the upper midwest were at the mercy of rail rates.⁸

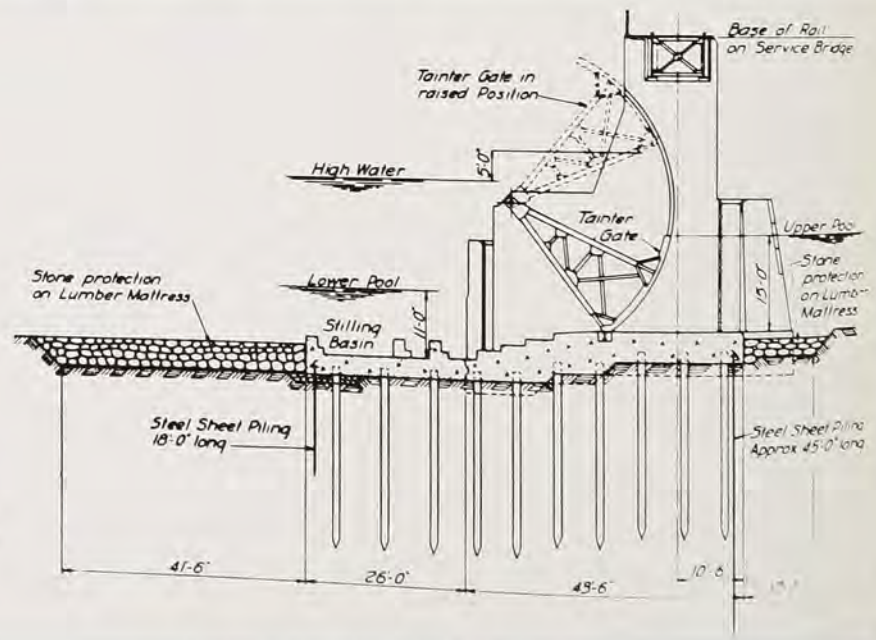
A nine-foot channel would mean an end to transshipment and a consequent reduction in rates. But the Engineers now realized that a nine-foot channel could not be achieved using the same methods which were applied to the rest of the river. The project which was recommended and ultimately adopted called for a series of low-water dams and locks to raise the river by creating what one historian has called an "aquatic staircase." The nine-foot project

would be achieved by construction of 24 low-water dams (in addition to two already in existence) which would create slack water pools from Alton, Illinois, to Minneapolis, Minnesota, rising 335 feet over 662 miles. Other alternatives had been considered, but the topography of the valley and the population patterns along the river militated against either open river regulation or high dams. Low dams had a number of advantages—they would not increase flood levels appreciably, nor would they create pools that would threaten existing settlements along the Mississippi. Furthermore, they would permit the levee systems below Muscatine, Iowa, to remain intact. On the other side of the ledger, such dams would be useful only for navigation; they would not aid in flood control nor could they be economically adapted to power generation.⁹

Thus a series of low dams was to be constructed which would result in the complete canalization of the upper Mississippi. But such a plan would be feasible only if the dams were adaptable to the natural conditions of the upper Mississippi. The dams had to be movable, since fixed dams would cause flooding dur-



Typical section of a roller gate.



Section through typical tainter gate.

ing freshets. They had to be strong enough to withstand the force of ice floes coming downriver in the spring and wide enough to allow the ice to pass through without creating ice jams. The dams also ought to permit migration of fish, to pass silt and sewage, and to aerate the water. Ultimately, the upper Mississippi project combined two types of gates to achieve these purposes—Tainter gates and roller gates. These gates could be lifted entirely out of the water when water levels were high enough to sustain navigation or when flood conditions prevailed.¹⁰

The roller gate was a relatively new engineering innovation that had been developed in Germany. It consisted of a large steel cylinder which rolled on tracks embedded in the concrete piers of the dam. "On the upstream side of the roller a steel apron extended along its length. When the gate was closed, the lower edge of this apron rested against a steel sill even with the riverbed." Structurally sounder than the Tainter gate, the roller gate could be made longer and thus more efficient in passing ice and drift. However, roller gates were more expensive to build, and they were still under patent as well, therefore requiring royalty payments for their use. The cheaper Tainter gate was "a pie-shaped wedge with the point downstream, hinged between piers, and the curved surface upstream forming a dam against the water." Because they were less expensive, Tainter gates were used wherever possible. During the thirties, improvements in design and materials eventually made it possible to construct wider Tainter gates, thus decreasing the need for roller gates. The locks, used "to pass river traffic vertically from one pool level to another," were generally a standard size—110 feet wide by 600 feet long. Together the 26 locks and dams would assure a navigable nine-foot channel on the upper Mississippi.¹¹

The St. Louis District was responsible for the design and construction of the bottom three steps of the aquatic staircase—Lock and Dam No. 24 at Clarksville, Missouri; Lock and Dam No. 25 at Cap au Gris, Missouri; and Lock and Dam No. 26 at Alton, Illinois. The Alton project was the first to be undertaken in the St. Louis District. Work on the main and auxiliary



Location of locks and dams on the upper and middle Mississippi.

locks began in January 1934; at all locations the locks were constructed first so that river traffic would not be interrupted. The idea of a lock and dam at Alton was not new. In 1905 a plan to secure a 14-foot channel on the Illinois-Mississippi waterway depended in large part on a lock and dam at Alton. When the 14-foot channel was rejected by the Corps, the Alton site was temporarily pushed aside.¹²



Site of Lock and Dam #26 at Alton prior to construction.

By May 1935 the two locks were two-thirds complete, and a contract was entered into for construction of the dam. From that point, events took a turn for the worse. In early 1936 the auxiliary lock cofferdam, which was partially completed, was destroyed by heavy ice moving down the river. Then, in April 1936, the original contract for construction of the dam was terminated, and a new contract was not signed until September. But just as natural conditions hampered progress in the case of the cofferdam destruction, so too could nature smooth the path, as in the case of the unusually low water conditions which prevailed throughout this section of the Mississippi during the decade of the thirties, making possible more rapid construction with fewer of the problems associated with high water. By January 1938 Lock and Dam No. 26 was completed; it was put into operation on May 1. The new dam consisted of 30 Tainter gates

(each 40 feet long by 30 feet high) and three roller gates (each 80 feet long by 25 feet high). The main lock was 600 feet long by 110 feet wide and the auxiliary lock was 360 feet long by 110 feet wide.¹³

The Alton project was, from its inception, visualized by the Corps of Engineers as a navigation project, but some local people saw the potential for even greater benefit by utilizing the Alton pool for recreation. A. P. Greensfelder, President of the St. Louis Plan Association, observed that "it is a curious fact to note that for the many years that the Mississippi River has been flowing by St. Louis, the current, velocity and turbidity of water have practically made it too dangerous and unattractive for recreational uses." Here, then, was an opportunity to exploit the possibility of recreation on the Mississippi. But use of the pool would involve building access roads, and the Corps had not been allotted any money for the acquisition of right of way for road construction. After considerable correspondence and some acrimony between these local groups and the PWA, in July 1938 the regional PWA office in Chicago finally approved the spending of \$900,000 for a scenic drive along the Mississippi from Alton to Grafton. The project called for the employment of 1800 WPA workers.¹⁴

Supporters of the recreation project feared that St. Louis District officials would be reluctant to cooperate with any undertaking outside the realm of navigation. Those fears were articulated by John D. McAdams, chairman of the WPA project at the Alton pool and editor of the *Alton Evening Telegraph*, in a letter to Colonel Paul S. Reinecke, the St. Louis District Engineer: "You men are Army Engineers and must see the picture from the standpoint of navigation. If we could come a bit closer together and have the War Department see the picture of beautification and recreation on the banks of this navigable lake, would not the whole improvement be brought to a place where it would serve the whole people—not only those interested in river transportation but those interested in recreation and beauty." But there was no conflict in the offing. Col. Reinecke assured McAdams that "I still enjoy seeing dogwood, redbud,



Lock #26 under construction.

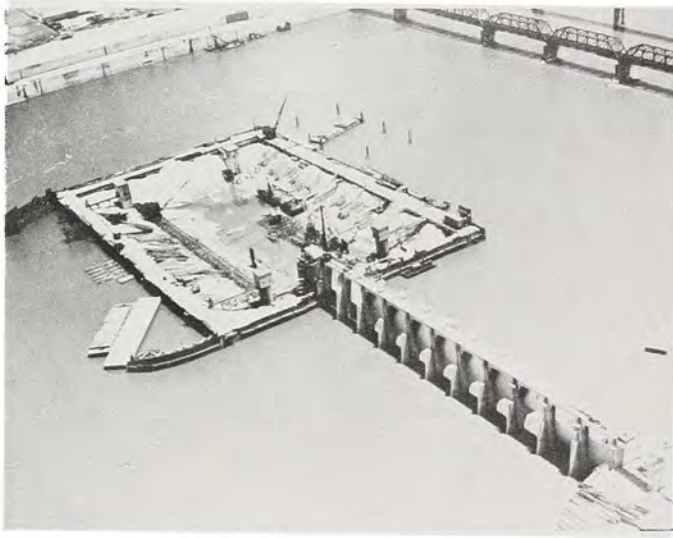


Colonel P. S. Reinecke
District Engineer, July 22, 1935-July 15, 1940.

and hawthorne blossoms (even though I am an Army engineer).” To his formal response he appended an informal note, “friend to friend,” containing the following definitions:

A W.P.A. man is said to be a man who knows a great deal about very little and who goes along knowing more and more about less and less until finally he knows practically everything about nothing; whereas an editor, on the other hand, is a man who knows a very little about a great deal and keeps knowing less and less about more and more until he knows practically nothing about everything. An engineer starts out knowing practically everything about everything, but ends up knowing nothing about anything, due to his association with editors and W.P.A. men.

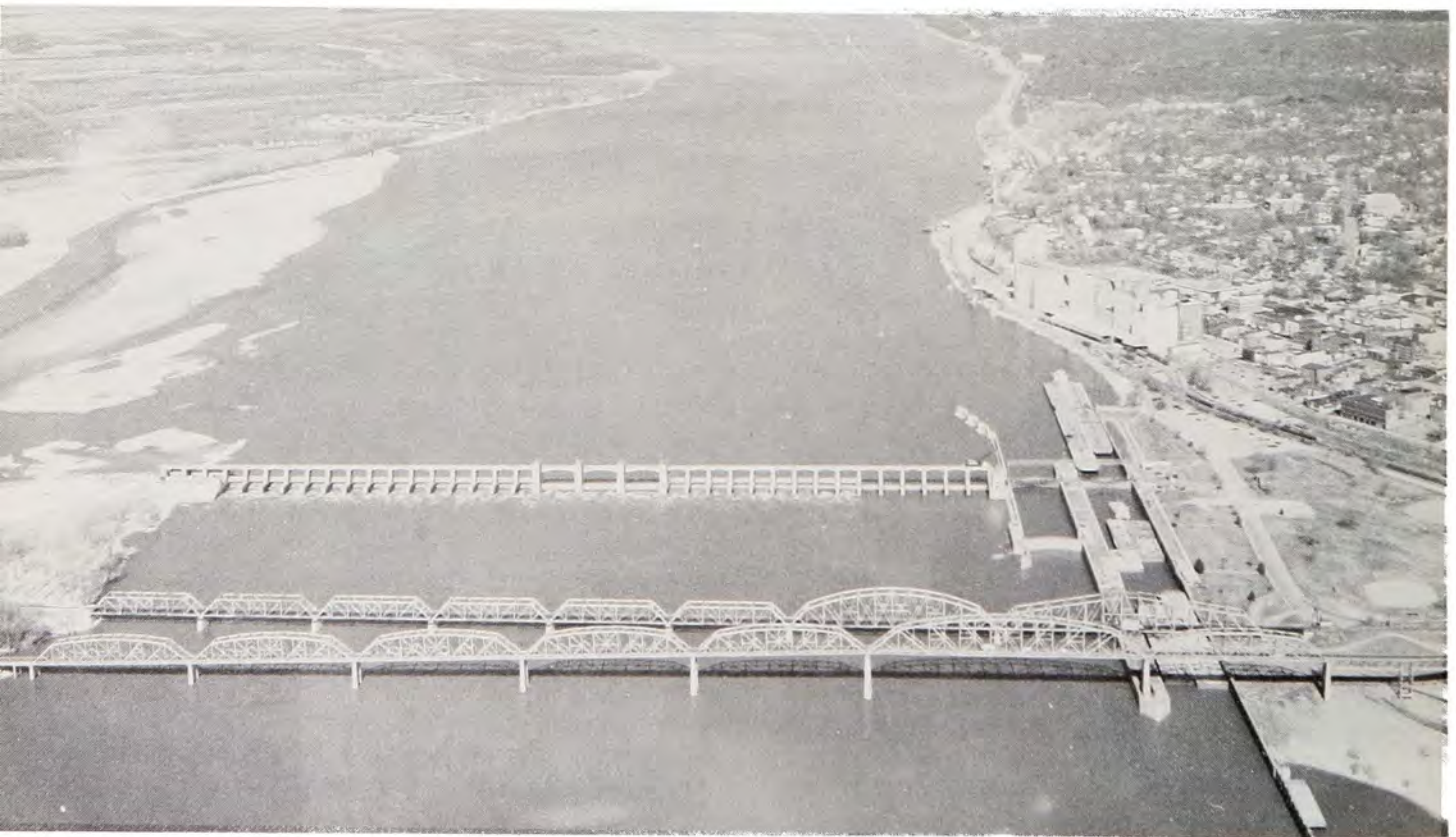
Just as revealing of Reinecke’s personality as the anecdote itself is the exchange pencilled across the bottom of the copy of the letter in the District records. The



Construction of the middle portion of Dam #26 at Alton.

first remark reads "Too bad we can't send this. B." (Harland Bartholomew, planning engineer). The second notation says simply "We can. P.S.R." and the third says "This for file room and Col. wants orig. to go with letter to Mr. McA." Undoubtedly Reinecke's sense of humor served him well during the hectic years of his tenure as St. Louis District Engineer. Despite the fact that the citizens' group suspected the worst of him, Reinecke obviously supported the recreation plan personally. Six years later Corps participation in recreation development would be formalized in the Flood Control Act of 1944.¹⁵

The cost of Lock and Dam No. 26 (officially designated the Henry T. Rainey Dam) was



The completed Lock and Dam #26. Note the increased width of the river upstream.



The first steamer going through Lock #26, June 2, 1937.



In the first year of operation of Lock #26, Engineer employees tried various measures to cope with ice, including attempting to break it up by hand.

\$13,119,500. Yet such an investment was relatively insignificant considering the importance of the structure. This location has been described as "the crossroads of the inland waterway system in the central United States. All downbound traffic from the Upper Mississippi River and Illinois River must pass through these locks to reach the Missouri River on the west, the Ohio River on the east, and the lower Mississippi River to the south." Equally important in the short run was the fact that the construction projects created hundreds of jobs during the bleak years of the Depression. But its greatest import lay in its implications for the future of river traffic. During its first year of operation, 1.4 million tons passed through the Alton lock; by 1974, traffic totalled 52.9 million tons.¹⁶

Lock and Dam No. 25, while not as crucial in location as No. 26, was equally significant to the concept of the nine-foot channel. Each dam was an integral and necessary part of the project. Construc-

tion of No. 25 was initially underwritten by the Emergency Relief Appropriation Act of 1935 with an eye to creating additional employment in the Missouri-Illinois area, although some regular funds were eventually used as well. The main lock was built between 1935 and 1937; the dam was started in 1937 and put into operation on May 18, 1939. The main lock was identical to the one at Alton, but the dam reflected technological advances that had occurred since the Alton dam was designed. The fourteen Tainter gates used at No. 25 were 60 feet long by 25 feet high; only a few years before, the maximum length of a Tainter gate was 30 to 40 feet. In addition, Dam No. 25 had three roller gates, each of which was

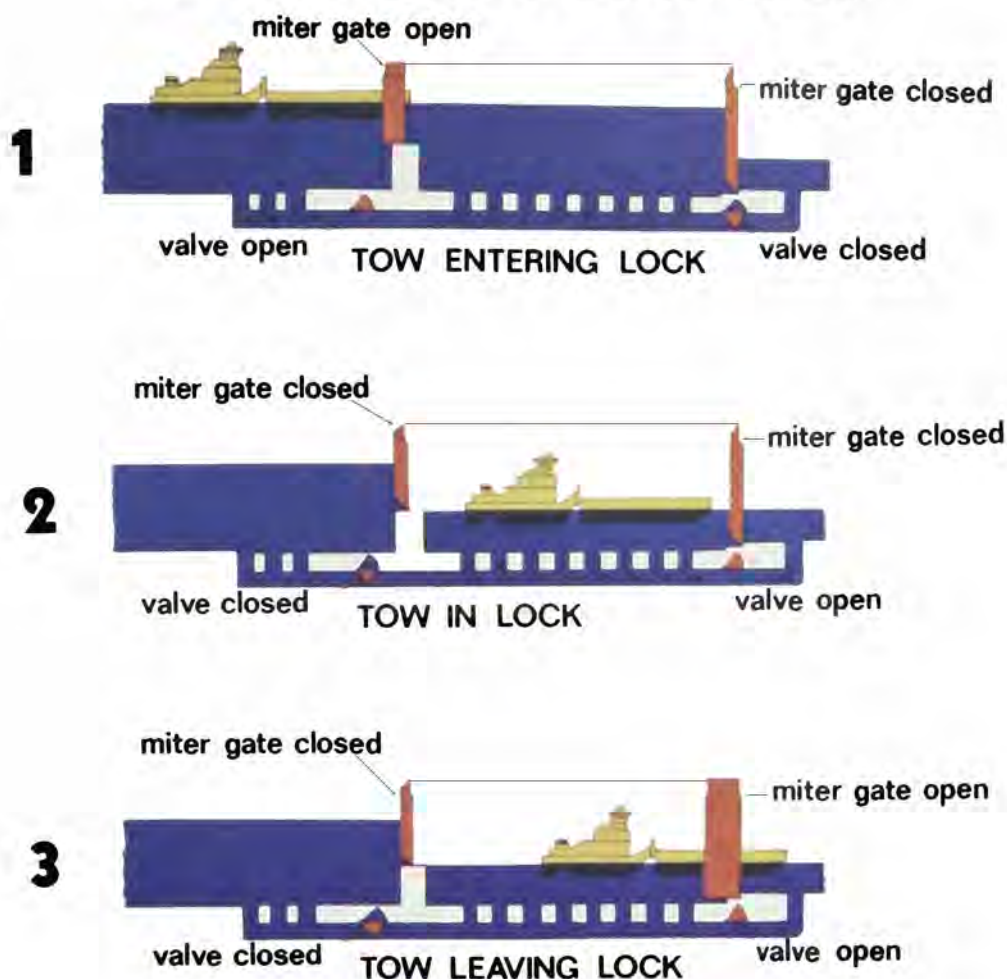
100 feet long by 25 feet high. The total cost of the project was \$8,687,600.¹⁷

The final lock and dam constructed during this period in the St. Louis District was No. 24 at Clarksville, Missouri. Initial construction of the lock (600 feet by 110 feet) began on July 20, 1936. The fact that the dam, which was begun in 1938, utilized only Tainter gates (fifteen of them, each 80 feet in length by 25 feet high) was reflected in the lower cost of this project compared to Nos. 25 and 26, which used roller gates as well as Tainter gates. No. 24, which was put into operation on March 12, 1940, cost only \$6,817,900.¹⁸



Almost from the beginning, Lock #26 experienced problems. Here a diver descends to investigate a section of the dam where an unusual discharge was indicated.

HOW A LOCK OPERATES



Thus by 1940 the St. Louis District had completed its portion of the canalization project, and the District Engineer reported that a nine-foot channel was being maintained for the first time in that part of the Upper Mississippi. The overall Upper Mississippi canalization project was 87 percent complete by the end of 1940. In 1931, the Corps had estimated that the project would cost \$140,000,000, but by the end of the decade the estimate had been revised upward to \$170,000,000 because of changes in the project—still a relatively modest investment, in part, at least, because of the availability of cheap labor during the Depression.¹⁹

The changes wrought by the nine-foot channel extended beyond its effect on navigation and the jobs the project created. For the first time, the banks of the Upper Mississippi were regularized and riparian land owners could realistically expect their riverfront

property to remain contiguous to their inland property rather than washing downstream. Farmers also benefited by having a cheaper alternative to rail transportation of their crops. In addition, river towns were reinvigorated by the increase of river traffic, as well as by the new importance of the Upper Mississippi as a recreational resource. Recreation planning on the Mississippi was made possible by the creation of slack water pools, and the Corps cooperated with the National Park Service to insure maximum benefit from the new project. The nine-foot depth also provided improved conditions for fish and wildlife. Ira Gabrielson, Director of the Fish and Wildlife Service in the thirties, claimed in a book published in 1943 that no single conservation organization could have helped wildlife as much as the nine-foot channel did. Before the project was undertaken, it was not uncommon for millions of fish to be caught in sloughs

by low water and die. "In fact, the State of Illinois even built and operated a steamboat whose main purpose in life was to rescue these dying fish and put them in deeper water." Another way in which the project contributed to the welfare of fish and wildlife was by reclaiming 194,000 acres of sloughs and back water which the Corps gave to state and Federal wildlife services for use as wildlife refuges.²⁰

St. Louis had by 1940 completed its role in creating a nine-foot channel on the upper Mississippi. Now it was only a matter of time until that stretch of the river would enjoy a new era in navigation and commerce.

Meanwhile, navigation improvements of the more traditional sort still comprised a key component of the District's role. These improvements were carried on in a variety of locations, because the thirties was a period of shifting District boundaries. In addition to its new upper Mississippi responsibilities, the District was, from 1930 to 1935, in charge of the Missouri River from its mouth to Hermann, Missouri. During that brief period, the District built 316 dikes totaling over 175,000 feet in length and 38 revetments over 65,000 feet long at a cost of over 5 million dollars. In 1935 that section of the Missouri was transferred to the Kansas City District, but St. Louis was then immediately given charge of the Illinois River from its mouth to Havana, Illinois.²¹

Snagging continued to be part of the District's navigation improvement responsibilities, although it became progressively less significant as the river channel was regularized and revetments were extended. As a result of such changes, fewer trees washed into the channel and fewer wrecks occurred. Even more importantly, St. Louis's responsibilities for snagging were divided with the Memphis and Vicksburg Districts; beginning in 1930, the St. Louis District would be responsible only for the middle Mississippi. This new division of duties substantially lessened the District's involvement in snagging; henceforth, most of the District's efforts consisted of clearing banks of potential snags rather than actual snag removal, in part because snag boats were needed

more on the lower Mississippi, in part because clearing banks put more men to work from the Depression-swollen ranks of the unemployed, and in part because with channel regularization there were fewer snags. In 1939, for the first time in over fifty years, the District Engineer reported that the St. Louis District had done no snagging.²²

The major navigation-related responsibility of the District continued to be the regularization of the middle Mississippi River. Between July 1930 and June 1945 the District expended almost 19 million dollars on the construction of new dikes and revetments on the middle Mississippi. Of that amount, 3.5 million dollars was from Public Works funds and \$664,000 was from Emergency Relief funds, appropriated during the mid-thirties when the Corps was being given special funds in order to create new construction jobs and thus fight unemployment. The amount spent on new work in this 15-year period was as much as had been previously spent on new work in the entire history of the project. The results were impressive: 768 dikes were constructed, totalling 404,000 linear feet, and 224 revetments, totalling 276,000 linear feet. This work had a number of beneficial effects: in conjunction with dredging, this construction helped maintain a nine-foot channel, which meant larger and deeper-draft barges could be used; the hazards of navigation were greatly reduced by the 9-foot depth; and the increased efficiency and reliability of barge traffic made possible by the nine-foot channel resulted in lower freight rates both by rail and by water. "Freight rates by rail to points on the Mississippi river and tributaries are much lower than to points only a few miles back from the river; freight rates by water are generally 80 percent of the rail rates."²³

Throughout the years of the Depression, the St. Louis District was able to maintain a nine-foot channel on the middle Mississippi during the navigation season (middle of February to middle of December) despite the very low water that prevailed throughout the period. Because of the low water, dredging was essential and the District sometimes had as many as eleven dredges working at one time; in the forties, on the other hand, when water levels were higher and



The sternwheeler *Delta Queen*, an excursion boat built in 1926.

regulating works further advanced, only three dredges were required. In fact, by the late thirties the combination of improved regulating works and efficient dredging on the middle Mississippi and the new locks and dams on the upper Mississippi had led shippers to continue navigation throughout the winter, "except when the river is actually blocked by heavy running ice or gorges." The navigation "season" was becoming a relic of the past.²⁴

But despite this progress made in regularizing the channel, the work of the District was still subject to the vagaries of the river. In 1936, for example, the same heavy ice which destroyed the cofferdam at the Alton lock construction site also wrecked 40,000 feet of dikes on the middle Mississippi. The winter of 1935-36 had been extremely cold, causing formation of heavy ice as far south as Memphis, with the river freezing over in many places down to Cairo. "Rivers within the district were not clear of ice until early in March, when ice ran out on a medium high stage causing serious damage to piling dikes." The entire construction season of 1936-37 was given over to repairing and replacing dikes damaged by the ice.²⁵

Nor was the middle Mississippi itself ready to submit to the restraints imposed by man. It continued to attempt to alter its own course, sometimes successfully. Many older dikes became obstructive as the river channel changed, and after 1937 dredges began removing old dikes as well as dredging shoals. But man, in the form of the Corps of Engineers, was beginning to get the upper hand. As engineering knowledge advanced and as construction materials and methods improved, there were fewer instances reported of the river choosing its own path. Regularization of the middle Mississippi was significantly aided by the development and utilization of the Waterways Experiment Station at Vicksburg, Mississippi, where a huge scale model of the river was maintained for experimental model studies to examine the effects of possible changes on the flow of the river.²⁶

Navigation improvement, then, continued to comprise an important part of the District's functions; but events were transpiring at the national level which would thrust the district into a new area of respon-



Colonel Roy W. Grower
District Engineer, July 15, 1940-August 4, 1942.



Colonel Lawrence B. Feagin
District Engineer, August 4, 1942-August 25, 1946.

sibility—flood control. Both Corps of Engineers and Congressional attitudes toward the issue of flood control had begun to change to some extent as a result of the flood of 1927. But it was the Flood Control Act of 1936 that marked a new departure in federal flood control policy. For the first time the federal government assumed responsibility for protecting its citizens and their property from the damage caused by floods. "Protection could be provided if benefits to whomsoever they accrued exceeded the cost"—the genesis of the benefit-cost ratio approach which is still used by government agencies to evaluate economic efficiency. Furthermore, the 1936 act "marked the birth of multiple purpose development by the Corps of Engineers."²⁷

The 1936 Act, which had been prompted by disastrous floods throughout the nation in 1935 and 1936, provided for three methods of flood control, all structural in nature: levees and dikes to confine the waters, improved run-off of flood waters through channel improvement, and reservoirs to hold back flood waters. Although these alternatives represented a

substantial further modification of the "levees only" philosophy (a modification begun in 1928), the use of other than structural means of flood control (such as zoning) was still some years in the future. The most immediate impact on the St. Louis District came from that part of the act providing federal aid to local levee districts. The act provided for local cost sharing; if levee districts could meet this requirement, the Corps would construct or improve levees in order to provide greater protection from flooding. Thus the Mississippi River levee system, which one contemporary writer enthusiastically asserted "overshadows even the Great Wall of China," would be augmented and strengthened in the St. Louis District as local funds were made available.²⁸

The Flood Control Act of 1936 authorized approximately 270 construction projects, 21 of which were in the St. Louis District. Of that number, 15 were for building and enlarging existing levees on the Mississippi River and six were for levee work on the Illinois River. In 1937, one million dollars was made available for construction in the St. Louis District; by 1938,

construction had begun in five levee districts and plans had been prepared in fourteen others. Participation in the levee program would be encouraged by the Flood Control Act of 1938—it substantially reduced local cost-sharing requirements. Another part of the act authorized a number of additional levee projects in the St. Louis District. By 1940, projects were underway in ten districts. By 1945, three projects had been completed and fourteen were at various stages of construction, although some pro-

jects had been placed in limbo until after the war. Total expenditures on these projects to June 30, 1945, totaled over \$3,800,000. Clearly flood control had come of age as a component of the District's mission.²⁹

But as in every long-term undertaking on a river the size of the Mississippi, progress was not linear, for the river was not predictable. In 1943, 1944, and 1945, spring floods on the middle Mississippi, Illinois, and Kaskaskia Rivers played havoc with levees and other flood control structures. Over \$7 million was allotted



The flood of May 1943 caused considerable damage in the District. This scene occurred when the flood wall at Claryville, Missouri, broke.

to the St. Louis District to cope with the emergency situations created by these floods. Emergency work by the District included conducting rescue and evacuation operations during the floods, reenforcing levees to prevent breaches, and repairing breached and eroded levees. The floods also highlighted the inadequacies of the existing levee system, resulting in the establishment of new levee grade objectives in the St. Louis District. Furthermore, if the point needed new emphasis, the floods reminded Congress and the Corps that there could be no relaxation in the struggle with the river.³⁰

Flood control work in the District was curtailed somewhat by the coming of the Second World War, although the Chief of Engineers argued strongly for

the continuation of flood control projects in the event of American entry into the war. In his Annual Report in 1941, the Chief pointed out that "all flood control projects, being directly connected with the national economy, are either directly or indirectly related to national defense, especially when it is remembered that one major flood in a large river basin, such as the Ohio or Mississippi, may accomplish in a few weeks many times the damage caused by countless air raids." But by 1942, pressures on manpower, materials, and construction equipment resulted in the suspension of those projects not directly related to the war effort. The definition of what projects were "related" was somewhat vague, but that issue became academic after the aforementioned floods forced the



The 1943 flood was so high in some areas that amphibians had to be brought in to aid in rescue work, as pictured here at Menfro, Missouri.



In 1944 another flood struck the District, including Cape Girardeau pictured here.

District back into large-scale flood control work to repair flood-related damage.³¹

In 1944 another significant Flood Control Act was passed by Congress. This act had two components of long-range importance. First, it provided that all subsequent navigation and flood control projects would be subject to the approval of the affected states and thus represented "a new milestone in inter-governmental cooperation." Second, the act articulated a new policy for the development of recreation facilities at reservoirs, stipulating that "all such public reservoirs shall be open to public use generally without charge for boating, swimming, bathing, fishing, and other recreational purposes, and ready access to and exit from such water areas...shall be maintained for general public use." This new responsibility marked another important step toward true multiple purpose development of water resources.³²

Meanwhile, the environment in which the Corps was operating had changed drastically. The outbreak of hostilities in Europe and the eventual entry of the United States into World War II turned the national and local economies around; the Depression was over at last. The war also meant a new significance for Corps activities. Unimpeded navigation became essential. Petroleum products came up the river and ships floated down the river; a total of "3,943 Army and Navy craft and other vessels for use in the war—destroyer escorts, fleet submarines, landing craft, freighters, tankers, and oceangoing tugs—moved from inland shipyards down the Mississippi to the sea." Of that number, more than 2000 passed St. Louis, including submarines in floating drydocks. "If for no other reason, the total expenditure for regulating works was justified," wrote Colonel Rudolph E. Smyser, Jr. Such navigation would not have been



In June 1945 a flood on the Meramec River produced this scene in Valley Park, Missouri.

possible without the Corps' modifications of the Mississippi channel. Although river shipments were not as great as some barge operators had hoped—primarily due to the long delivery time of river commerce and to a shortage of barges—they were nonetheless crucial. In addition, toward the end of the war a large amount of grain was shipped down the Mississippi for transshipment to Europe as part of the civilian aid program.³³

But the military emphasis on navigation was simply a reaffirmation of already existing responsibilities. The Corps was also given an entirely new duty—military construction. Prior to World War II, military construction had been the province of the Quartermaster Corps. But the Quartermaster organization was inadequate for an undertaking the size of that demanded by mobilization for war. Thus, in November 1940, supervision of construction of military and civilian airfields was assigned to the Corps of Engineers. Then, in December 1941, all military construction was transferred to the Engineers. By July 1942, Congress had charged the Corps of Engineers with constructing over \$10 billion worth of projects. The construction activity was sometimes frenetic, always demanding, and ultimately short-lived: "from its peak in 1942, construction activity declined rapidly. As emphasis shifted from facilities to production, and as the spotlight swung from home-

front preparations to combat in war theaters, construction workers moved on to factories and fighting fronts, construction officers moved overseas, and contractors turned to such unfamiliar tasks as maintaining railroads."³⁴

St. Louis was one of the most important Districts in the nation in terms of military construction. The District supervised construction of an estimated \$500,000,000 worth of facilities. Although most of the construction was done by private firms under contract, the District expanded its own construction activities as well. Civilian personnel of the Corps increased from 777 in April 1941 to a peak of 3415 in August 1942. To handle this rapidly expanding area of responsibility, the Corps of Engineers assigned 32 engineer officers to the St. Louis District as project officers. The project officers—each construction project had one—included regular engineer officers, reserve officers, and civilian engineers given emergency commissions. Although they remained in St. Louis, two of the project officers were assigned to the Manhattan Project (development of the atomic bomb); among their primary duties was finding surplus material from other projects for the project. But the majority of project officers were in charge of construction.

Among the twenty-one construction projects in the St. Louis District were nine involving ordnance

production. They ranged from a small arms ammunition plant (St. Louis Ordnance) to a plant that manufactured Caterpillar engines (Victory Ordnance in Decatur, Illinois). The District also was responsible for construction of much of Scott Field. At one time a dirigible field, Scott was now designated an Army Air Force station and thus had to be modernized and expanded. The Engineers had to provide it with everything from runways to hospitals, from barracks to hangars. Another project which called for expanding and modernizing an existing facility was the Air Force Replacement Center at Jefferson Barracks. Although Jefferson Barracks had been in existence since the time of Robert E. Lee, it had degenerated to such an extent that most of its facilities were unusable.

Two of the more unusual projects undertaken by the District were the Alien Enemy Internment Camp at Weingarten, Missouri, and the LCT Project at the District service base. The Weingarten camp was designed to hold aliens who were considered a potential threat to national security. Obviously it required the same kind of service facilities as Scott Field or Jefferson Barracks in terms of water supply, sewage, barracks, roads, and other essentials for human habitation. It also required barbed wire fences and guard towers. The LCT project involved receiving shells of landing craft from upriver and installing machinery and otherwise preparing them for service. The District service base outfitted approximately 50 LCT's during the course of the war and dispatched them down the river, bound for the front.³⁵

The project officers not only let contracts and presided over construction, they also expedited procurement of machinery and materials. Few private firms had adequate construction machinery for the large-scale projects being built at this time. As a result, the District served as a clearing house for construction equipment, which was loaned out to the contractors for the duration of the project and then returned to the District to be re-allotted. When this equipment was no longer needed in the St. Louis District, it was sent elsewhere; much of it was eventually used in constructing the Alaskan Highway. Materials

were also allotted to contractors through the District.

Another important responsibility of the District during the war was procurement of supplies for military installations. Every conceivable need of those installations had to be met; the District procured everything from firetrucks and oxygen to steel landing mats.

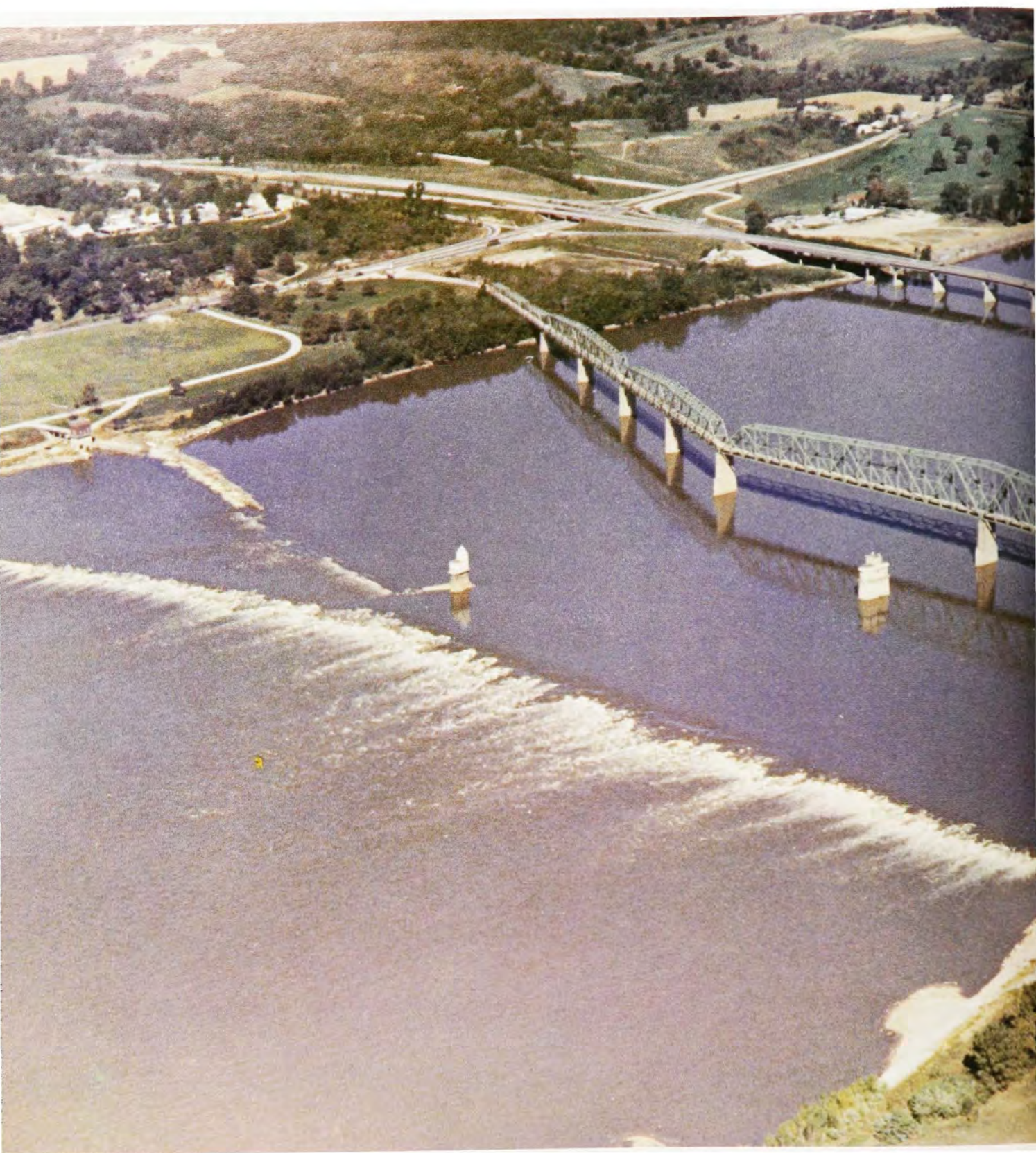
Late 1942 marked the peak of construction in the District, although some activity was still in progress when the war ended. By 1944, the project engineers were being sent elsewhere, many of them overseas. But the brief life-span of military construction in the District in no way lessened its significance for the war effort. Essential supplies were produced and crucial training services provided at the projects built under the supervision of the St. Louis District. The rationale for the Corps' public works—that civil works would prepare engineers for wartime—received a resounding affirmation, as the Corps proved its ability to mobilize in the face of a wartime emergency.³⁶

World War II was a modern war. It was won as much in the factories as on the battlefield, and the District had done its part. But in 1945, as the war effort began to pay dividends and American victory seemed assured, an old spectre reappeared. Many Americans feared that the end of the wartime stimulus to the economy might mean a return to Depression. The Chief of Engineers reflected that concern in his report in 1945, emphasizing the backlog of worthy construction projects related to rivers and harbors which could help pick up any slack in the nation's economy. As early as 1941, the Chief had expressed his desire to have a sufficient number of projects "to cushion the shock of unemployment during the transition period following the present emergency." By 1945, Congress had provided authorizations for the construction of approximately 650 projects for flood control, totalling over one and one-half billion dollars. Thus the Corps was ready to resume its pre-war role as employer of the jobless in the new postwar world. Whether that role would be necessary remained to be seen; the country awaited the future with a combination of hope and apprehension.³⁷

Footnotes Chapter 5

1. Harry L. Purdy, *An Historical Analysis of the Economic Growth of St. Louis, 1840-1945* (St. Louis, 1946 [?]), 93-108; Bernard Axelrod, comp., "A Statistical Survey and Reference Guide to the St. Louis SMSA, 1900-1960," (unpublished manuscript, Olin Library, Washington University, St. Louis, 1964); William E. Leuchtenburg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York, 1963), 3; William E. Leuchtenburg, *The Perils of Prosperity* (Chicago, 1958), 253; Harry M. Hagen, *This Is Our St. Louis* (St. Louis, 1970), 466-74; Martin Towey, "The St. Louis Hooverilles," (unpublished manuscript in author's possession).
2. Leuchtenburg, *Perils*, 253-54.
3. Roger Daniels, "Public Works in the 1930s: A Preliminary Reconnaissance," *The Relevancy of Public Works History: The 1930s—A Case Study* (pamphlet published by the Public Works Historical Society, 1975).
4. Maj. Gen. Lewis A. Pick, *The Corps of Engineers in Peace and War* (Washington, D.C., 1949), 27; Leuchtenburg, *FDR*, 125; William C. Hart to Robert K. Ryland, December 24, 1935, Record Group 77, Federal Records Center, Kansas City.
5. Lt. Col. P. S. Reinecke to Sveinbjorn Johnson, April 6, 1936, Record Group 77, Federal Records Center, Kansas City. About 50% of the man-hours were worked by citizens of Illinois. Reinecke to Johnson. The District also had a contingency plan for use of WPA labor in emergency flood work. Lt. Col. P. S. Reinecke to Division Engineer, UMVD, March 20, 1936, Record Group 77, Federal Records Center, Kansas City.
6. *Annual Report of the Chief of Engineers, U.S. Army, 1932*, 1099; Purdy, *Economic Growth*, 110; "Merchant Marine of the Middle West," *Literary Digest* 124 (July 3, 1937), 37.
7. William L. Bryan to Lt. Green, July 12, 1937, Record Group 77, Federal Records Center, Kansas City; 44 *Statutes at Large*, 1010; U.S. Congress, House, *Report on Mississippi River and Minneapolis, Minn. (Interim Report)*, H. Doc. 71-290, 71st Congress, 2nd Session, 1-50, 1930; 46 *Statutes at Large*, 918.
8. 34 *Statutes at Large*, 1073; H. Doc. 71-290, 1-50.
9. H. Doc. 71-290, 1-50; Roald Tweet, *A History of the Rock Island District, Corps of Engineers* (Rock Island, Ill., 1975), ch. 9.
10. H. Doc. 71-290, 1-50; U.S. Congress, House, *Survey of Mississippi River between Missouri River and Minneapolis*, H. Doc. 72-137, 72nd Congress, 1st Session, 1-31, 1932; Tweet, *Rock Island*, 103; U.S. Army Engineer District, St. Louis, *Environmental Statement (Draft): Operation and Maintenance, Pools 24, 25, and 26, Mississippi and Illinois Rivers* (St. Louis, 1975), 4.
11. Tweet, *Rock Island*, 105; U.S. Army Engineer District, St. Louis, *Environmental Statement, Supplement, Vol. I (Draft), Locks and Dam No. 26 (Replacement)* (St. Louis, 1975), 20-21; S. G. Roberts, "Canalization of the Upper Mississippi River," *Scientific American* (February 1935), 72-74.
12. Benjamin Shearer, "The Construction of the Alton Lock and Dam," (unpublished manuscript in author's possession); Tweet, *Rock Island*, 105; U.S. Congress, House, *Survey of Des Plaines and Illinois Rivers*, H. Doc. 59-263, 59th Congress, 1st Session, 531-43, 1906; *Pools 24, 25, and 26*, 10; *Annual Report, 1934*, 794. For a discussion of preparation of construction sites for locks and dams on the upper Mississippi, see Herbert G. McCormick and John W. Dixon, "Mississippi River Cofferdams," *The Military Engineer* 28 (March-April, 1936), 105-8.
13. *Annual Report, 1935*, 903; *Annual Report, 1936*, 891; *Annual Report, 1938*, 1058; *Pools 24, 25, and 26*, 10.
14. A. P. Greensfelder to Harland Bartholomew, June 19, 1935, Record Group 77, Federal Records Center, Kansas City; *St. Louis Globe-Democrat*, July 6, 1938.
15. John D. McAdams to Col. P. S. Reinecke, August 6, 1938, Record Group 77, Federal Records Center, Kansas City; Reinecke to McAdams, August 18, 1938, Record Group 77, Federal Records Center, Kansas City; 58 *Statutes at Large*, 887.
16. *Pools 24, 25, and 26*, 10; *Lock and Dam No. 26*, 24.
17. *Annual Report, 1935*, 907; *Annual Report, 1936*, 891-94; *Annual Report, 1937*, 939; *Annual Report, 1938*, 1057; *Pools 24, 25, and 26*, 9.
18. *Pools 24, 25, and 26*, 4-7; *Annual Report, 1938*, 1057; *Annual Report, 1940*, 1161; P. S. Reinecke, "The Rhine and the Upper Mississippi," *The Military Engineer* 30 (May-June, 1938), 170.
19. *Annual Report, 1940*, 1162-64; Tweet, *Rock Island*, 102, 108-110.
20. E. M. Kniestedt to District Engineer, August 2, 1933, Record Group 77, Federal Records Center, Kansas City; Tweet, *Rock Island*, 102-3, 110; Ira Gabrielson, *Wildlife Refuges* (New York, 1943), 193; James V. Swift, "River Transportation in Those 'Good Old Days,'" *St. Louis Post-Dispatch* (May 16, 1976), 9J.
21. *Annual Report, 1932*, 1153; *Annual Report, 1933*, 709; *Annual Report, 1934*, 825; *Annual Report, 1935*, 989; William L. Bryan to Lt. Green, July 12, 1937, Record Group 77, Federal Records Center, Kansas City; *Annual Report, 1936*, 862.
22. *Annual Report, 1931*, 1199; *Annual Report, 1935*, 889; *Annual Report, 1939*, 1122.
23. *Annual Reports, 1931-45*; *Annual Report, 1932*, 1094.
24. *Annual Report, 1941*, 1101; *Annual Report, 1932*, 1096; *Annual Report, 1933*, 665; *Annual Report, 1943*, 908; *Annual Report, 1945*, 1223; *Annual Report, 1940*, 1121-22.
25. *Annual Report, 1936*, 864-66; *Annual Report, 1937*, 903; Roy W. Grower to W. H. Moeglein, October 20, 1939, Record Group 77, Federal Records Center, Kansas City. At one time the idea of dropping bombs from airplanes to break up ice gorges was advanced by certain rivermen, but the plan received no support from District Engineer William A. Snow. See Snow memorandum, "Removal of Ice in Mississippi River," file 7115/12, Record Group 77, Federal Records Center, Kansas City.
26. *Annual Report, 1937*, 909; *Annual Report, 1938*, 1023; *Annual Report, 1938*, 1016; *Annual Report, 1940*, 1121. For further information on the Waterways Experiment Station, see Col. A. P. Rollins, Jr., "The Waterways Experiment Station," *The Military Engineer* 50 (November-December, 1958), 353-55, and Brig. Gen. Herbert D. Vogel, "Origin of the Waterways Experiment Station," *The Military Engineer* 53 (November-December, 1961), 132-39.
27. 49 *Statutes at Large*, 1570; John Furman Wall, "The Civil Works of the United States Army Corps of Engineers: Program Modernization," (unpublished Ph.D. dissertation, Cornell University, 1973), 172, 223-24. Multiple purpose development is defined as a project serving two more primary purposes. James S. Bowman, "Multipurpose River Developments," *Transactions, American Society of Civil Engineers* 100 (1953), 1125. Bowman contends that multipurpose planning in the Corps begins

- with the Flood Control Act of 1938.
28. Wall, "Civil Works," 172, 223-24, B89; 49 *Statutes at Large*, 1570; Frederick Simpich, "Men Against the Rivers," *National Geographic Magazine* 71 (June 1937), 767. In 1937, one of the largest floods in history inundated the Ohio and lower Mississippi valleys, but it did no damage in the St. Louis District. See American Red Cross, *The Ohio-Mississippi Valley Flood Disaster of 1937* (Washington, D.C., 1938).
 - It should be noted that District boundaries for flood control differed from the boundaries for navigation improvement. St. Louis's flood control responsibilities extended from Cape Girardeau, Missouri, to Clarksville, Missouri, on the right bank and from Thebes, Illinois, to Hamburg Bay, Illinois, on the left bank. William L. Bryan to Lt. Green, July 12, 1937, Record Group 77, Federal Records Center, Kansas City.
 29. *Annual Report, 1936*, 876-77; *Annual Report, 1937*, 6-7; *Annual Report, 1938*, 1026-45; 52 *Statutes at Large*, 1215 (some of these cost-sharing requirements were reinstated for projects authorized after 1941, 55 *Statutes at Large*, 638); Wall, "Civil Works," B90-91; *Annual Report, 1939*, 8; *Annual Report, 1940*, 1130-49; *Annual Report, 1941*, 1111; *Annual Report, 1942*, 1003; *Annual Report, 1943*, 914-33; *Annual Report, 1945*, 1229-51. The \$3,800,000 figure includes \$281,000 for repairs necessitated by the May-June flood of 1943.
 30. *Annual Report, 1943*, 932-33; *Annual Report, 1944*, 8-10, 920-22, 934-36; *Annual Report, 1945*, 1248-50.
 31. *Annual Report, 1941*, 8; *Annual Report, 1943*, 6.
 32. 58 *Statutes at Large*, 887; *Annual Report, 1945*, 5-6; Wall, "Civil Works," B91.
 33. Mississippi River Commission, *Mississippi River Navigation* (Vicksburg, Miss., 1970), 6; "Wartime and the River," *Fortune* 26 (July 1942), 69-75, 102-7; Col. R. E. Smyser, Jr., "Effects of Navigation Work on Flood Flows in the Middle Mississippi River," *The Military Engineer* 41 (May-June 1949), 183; "Inland Freight Hit," *Business Week* (March 27, 1943), 22-23; Chester Wardlow, *The Transportation Corps: Responsibilities, Organization, and Operations*. (Washington, D.C., 1951), 369.
 34. Lenore Fine and Jesse A. Remington, *The Corps of Engineers: Construction in the United States* (Washington, D.C., 1972), 244-72, 440-76, 485, 586.
 35. The nine ordnance-related projects were the St. Louis Ordnance Plant Project, St. Louis; the Weldon Springs Ordnance Works Project, Weldon Springs, Missouri; the Missouri Ordnance Works Project, Louisiana, Missouri; the Oak Ordnance Plant Project and the Sangamon Ordnance Plant Project, both in Illiopolis, Illinois; the Victory Ordnance Plant Project, Decatur, Illinois; the Chevrolet Shell Division Forging Plant Project, St. Louis; and the Tyson Valley Powder Farm Project, St. Louis County. Projects related to providing training facilities included the Air Force Replacement Project, Jefferson Barracks, Missouri; the Army-Air Force Station Project, Scott Field, Illinois; an airfield for the 124th Observation Squadron, Vichy, Missouri; the Curtiss-Wright Factory Training School Project, Robertson, Missouri; and the Military Policy Battalion Project, Mt. Vernon, Illinois. The remaining projects were varied: the Chemical Warfare Service Plant Project, Monsanto, Illinois; the Granite City Engineer Depot and the Granite City Storage Area, both in Granite City, Illinois; the St. Louis Medical Depot Project, St. Louis; the Alien Enemy Internment Camp, Weingarten, Missouri; and the St. Louis Towboat and Barge Project, and the LCT Project, both in St. Louis. Richard J. Maxwell, "Mobilization of the Field (St. Louis District) Organization in World War II," May 1964 memorandum, St. Louis Army Engineer District files.
 36. The preceding account of military construction and procurement was based on Maxwell, "Mobilization," and interviews with Max Lamm, Milton Mindel, and Richard J. Maxwell, all long-time Corps employees. See also Hagen, *This is Our St. Louis*, 531-33, and United States Department of Labor, *Impact of the War on the St. Louis Area* (Washington, D.C., 1944).
 37. *Annual Report, 1945*, 6-7; *Annual Report, 1941*, 8-9.



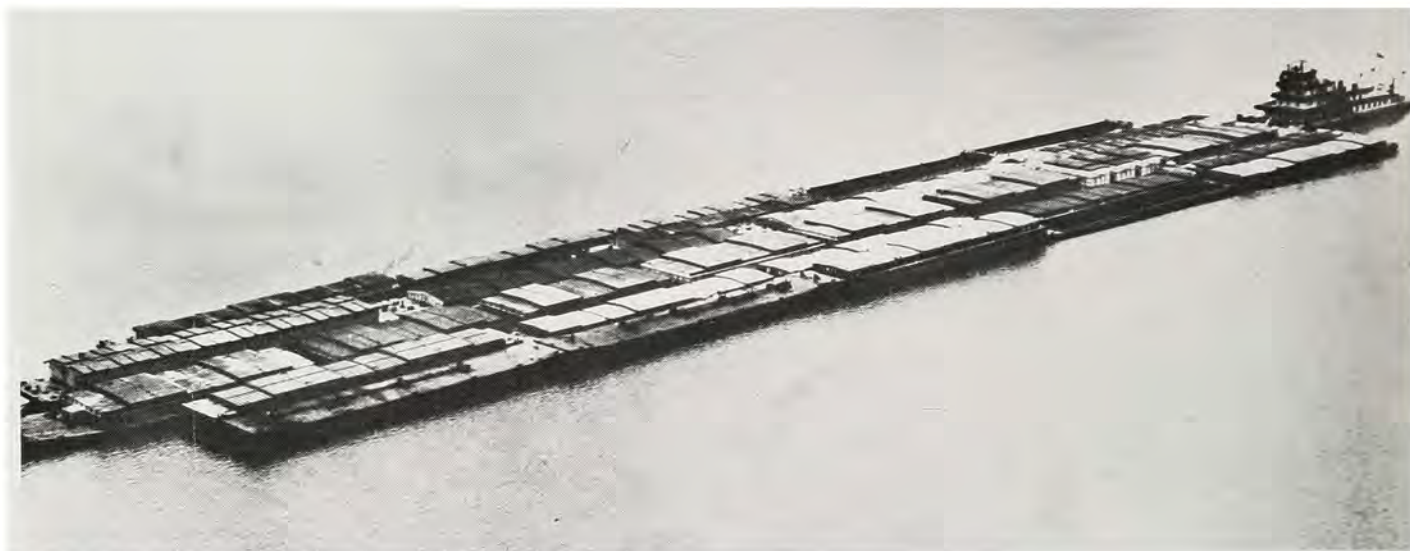
Dam #27 at the Chain of Rocks.



The Postwar Years: The Quiet Before the Storm

The large-scale wartime projects centered in the St. Louis District had temporarily lifted the region's economy from its slough of despond. But during the pivotal years 1945-1960, the St. Louis economy would once again slide inexorably into a state of economic lassitude. The surrounding region would continue to grow during those years, although not as much as some other parts of the nation, but the city of St. Louis itself was characterized by economic stagnation and residential deterioration. The downtown area did not witness construction of a single new office building between 1930 and the late 1950s. By 1958, unemployment had reached 71,800. Perhaps even more revealing was the city's population decline (by over 100,000) during the decade of the fifties. There were some bright spots, however. In 1955, voters approved the largest bond issue in St. Louis history—\$110 million (some of that money would serve as matching funds for a new Corps project—the St. Louis floodwall).¹

Another exception to the dismal economic picture in St. Louis was the river commerce moving through the Port of St. Louis. Between 1947 and 1956 the Port's annual tonnage grew from 2,259,894 to 7,408,279 tons. These figures reflected a general increase in the use of inland waterways—in 1947, barges carried 3.5 percent of all freight; fifteen years later the percentage had jumped to 6.2 per cent. During a ten-year period (1953-1963), commerce on the Middle Mississippi increased 124 per cent (27 per cent more than the Mississippi as a whole). The experience of World War II had shown that barges could provide a cheap, dependable means of transportation for bulk items, and shippers increasingly used the water-



Illustrative of the tremendous power of modern towboats is this picture of the Federal Barge Lines towboat *United States* pushing 42 barges.

ways in the postwar years. The combination of technological advance in the design and construction of towboats and barges, on the one hand, and continued improvements in navigation conditions, on the other, presaged a bright future for water-borne commerce. The renewed vitality and viability of river traffic was epitomized by the decision of the federal government to get out of the barge business after 35 years, when, in 1953, it sold the Federal Barge Line to private investors. River transportation no longer required federal guarantees; by 1953 there were over 700 transportation lines on the Mississippi system and the Gulf Intracoastal Waterway (more than a hundred of them headquartered in St. Louis, including two of the biggest—the Mississippi Valley Barge Line Co. and the Federal Barge Lines, Inc.).²

This rebirth of river commerce was predicated on the ability of the Corps to maintain a nine-foot depth on the Mississippi. The new tow boats, developing up to 9000 horsepower, and the new barges, carrying as much as 3000 tons, required a deep, dependable, regularized channel. Yet the middle Mississippi consistently posed challenges to that requirement. One of the most difficult stretches of the river was that sec-

tion between St. Louis and the mouth of the Missouri River known as the Chain of Rocks. This seven-mile stretch of river contained jagged rock ledges which jutted into the channel from the west bank. During low water it was difficult to maintain the proper channel depth because of these ledges; during high water, the ledges increased river turbulence and velocity. The Chain of Rocks not only caused accidents periodically, but they also frequently hampered the flow of traffic. At times, large tows had to be broken up so that barges could be maneuvered through the Chain of Rocks one or two at a time. This problem area had been identified by pilots long before any remedial action was taken. But as Colonel Paul S. Reinecke, District Engineer, put it, before canalization of the upper Mississippi was completed and regulating works and dredging on the middle Mississippi were advanced, "there were so many other places in the river giving trouble as much as or more than Chain of Rocks, that there were few kicks." He likened the situation to that of "a man with a toothache right after he had stepped in a wasp nest." However, as the other problems were solved, the "toothache" loomed larger and larger.³



Colonel Rudolph E. Smyser, Jr.
District Engineer, August 25, 1946-December 30, 1949.

A bypass canal had been considered as early as 1904, and a dam was suggested in 1933, but it was not until 1939 that the Chief of Engineers recommended construction of the Chain of Rocks canal, and it was 1945 before Congress finally authorized the project. Design work was done in the Upper Mississippi Valley Division office and construction was initiated under the supervision of St. Louis District Engineer Colonel Rudolph E. Smyser, Jr., in 1946. Colonel Smyser was a veteran of World War II. He had been in command of an aviation engineer brigade constructing the airfields for the Tactical Air Command supporting General Patton's Third Army and later was Chief Engineer for the Occupation Air Force responsible for initial reconstruction of many major European airfields. His return to civil works occurred in St. Louis, and his first major hurdle was the Chain of Rocks.

One of the first design problems at Chain of Rocks was the location of the upper entrance to the canal, which required careful planning. Although the entrance would be below the mouth of the Missouri,



Lock #27 on the Chain of Rocks Canal.

operation of the canal and locks would be greatly simplified if Mississippi rather than Missouri water could be directed into the canal. Mississippi water carried only 7 per cent as much silt as the Missouri and would therefore require much less dredging. Since the Missouri and Mississippi flowed side-by-side for a number of miles before fully integrating, it was possible, by locating the upper entrance in a bend of the river, to insure that Mississippi water would flow into the canal.⁴

The excavation of the canal was done by hydraulic dredges, and the excavated material was used to construct protective levees paralleling the canal. The easternmost levee was incorporated into the flood protection system of the heavily industrialized Granite City-East St. Louis area. Slightly more than a mile above the lower entrance to the canal double locks were built. Originally these locks had been designed to be the same size as the locks at Alton, but increasing river traffic demands indicated that longer locks were needed. The trend in river commerce was toward longer and longer tows pushed by

a single towboat—some tows were 1000 feet long. Clearly, efficient passage of these tows through the canal demanded a lock which would not require the tows to be broken and taken through the lock in two trips. As a result, the main lock was expanded to 110 feet by 1200 feet—a doubling of the original length; the auxiliary lock was also lengthened from 360 to 600 feet. Like the Eads Bridge of many years before, the locks' foundations had to be carried far below the natural ground level to reach a solid base—in this case, limestone was found seventy feet down. A substantial excavation was required to reach the limestone; once bedrock was found, loose and unsatisfactory rock was removed from the base area and the first lifts of lockwall monoliths were placed. Later, the area was grouted thoroughly. Throughout this process it was necessary to maintain well-points and pumping equipment around the excavated area to drain off seep water; excavation in a flood plain was inevitably hampered by the saturated soil and high water table.⁵

Even more than the upper Mississippi locks, the Chain of Rocks locks (No. 27) could anticipate great pressure from large quantities of water and ice. Therefore the upper gates had to be quite strong. Tainter, roller, sector, and miter gates were each considered and then discarded; each was found to be either too costly or impracticable. The design which was adopted was "double-leaf, vertical-lift, each leaf being operated like a lift bridge with both leaves acting together as does an ordinary double-hung window." Each leaf was 30 feet high by 115 feet long, with the upper leaf weighing about 270 tons. While the upper gates worked like a window, the lower gates worked much like a door. These were miter gates of the type used in locks 24, 25, and 26. The net effect of the new canal and locks was to eliminate what was perhaps the greatest remaining bottleneck on the Mississippi waterway system.⁶

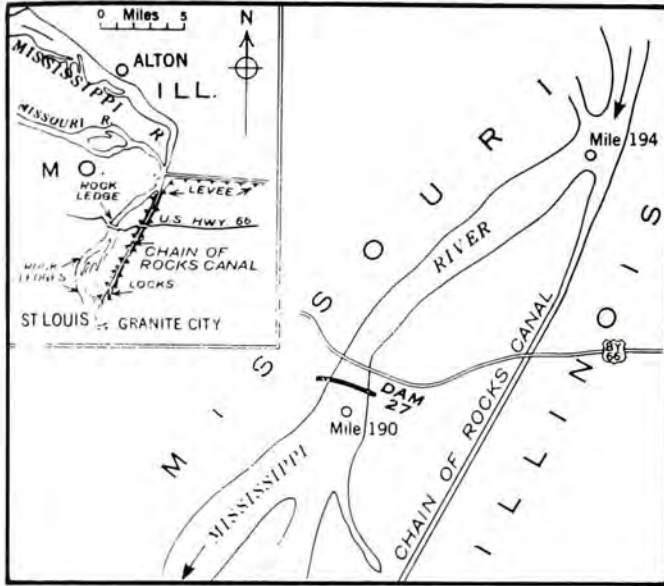
The problems on this stretch of the river below Alton did not end with construction of the canal and locks, however. While a 9-foot channel below the lock at Chain of Rocks could be maintained by dredging, a different problem arose at the lower end of Lock



Colonel Beverly C. Snow
District Engineer, December 30, 1949-January 29, 1951.

No. 26—the river level was at times so low that tows at full draft could not pass over the lower miter sill. To create a sufficient depth at low water, the District built a low water dam across the entire width of the Mississippi in the area of the Chain of Rocks. This dam would not impede high water flows, would not hamper navigation (because of the Chain of Rocks canal and lock), and would guarantee a 9-foot depth at the Alton lock during low water by creating a pool between the Alton lock and the new dam, No. 27. The dam was authorized in 1958, begun in early 1959, and completed in 1964.⁷

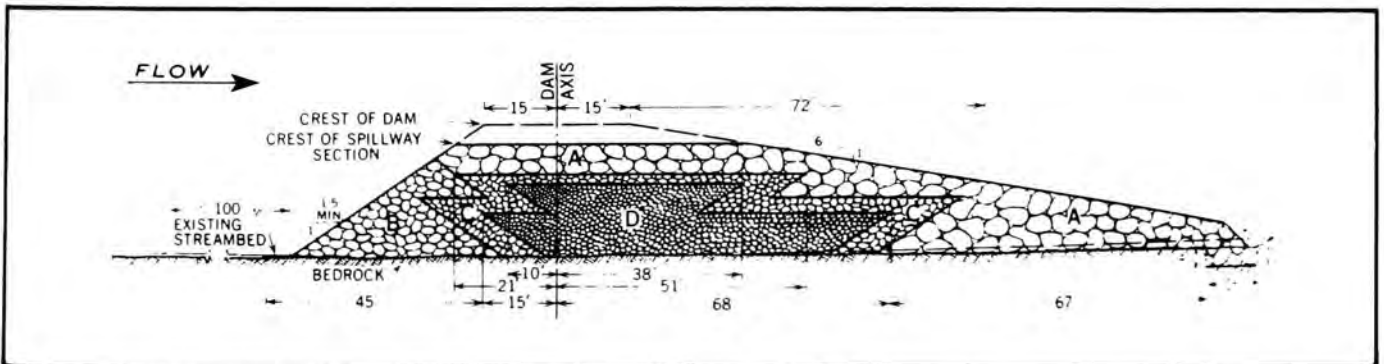
Dam No. 27 was notable for a number of reasons. It was the first complete barrier across the Mississippi, a fixed-crest rock dam 3240 feet long. It was also "the first dam ever undertaken on a major waterway without use of cofferdams, without dewatering, and without river diversion." The greatest difficulty lay in the area of theoretical engineering—how could rocks be placed so that they would resist the current



Site of Dam #27 at Chain of Rocks Canal.



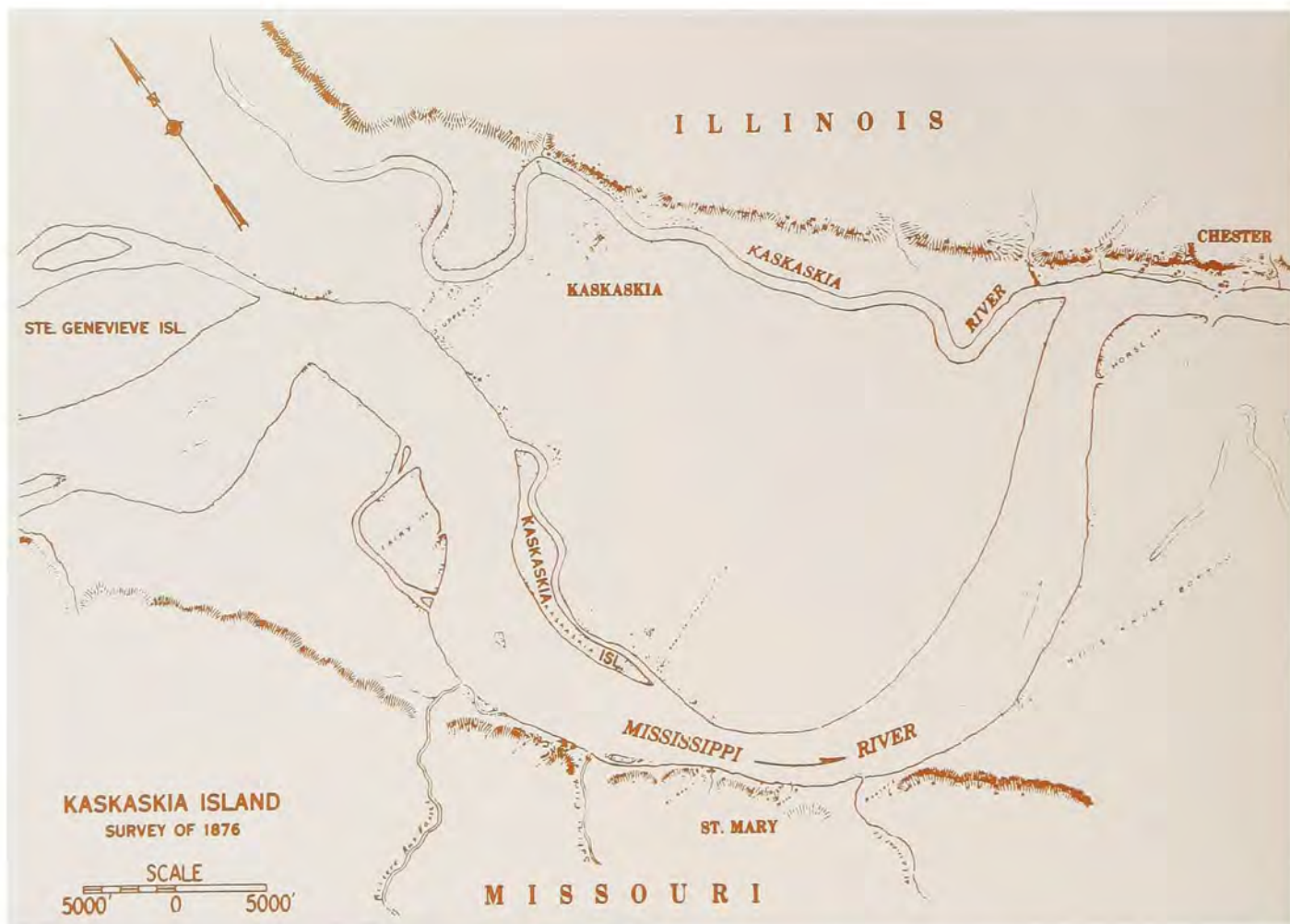
Placing rocks for Dam #27.



Cross-section of Dam #27.

and remain stationary? Use of model studies indicated a scheme of placement which would result in an economical, rapidly constructed, and permanent structure. The dam included a 700-foot fixed spillway

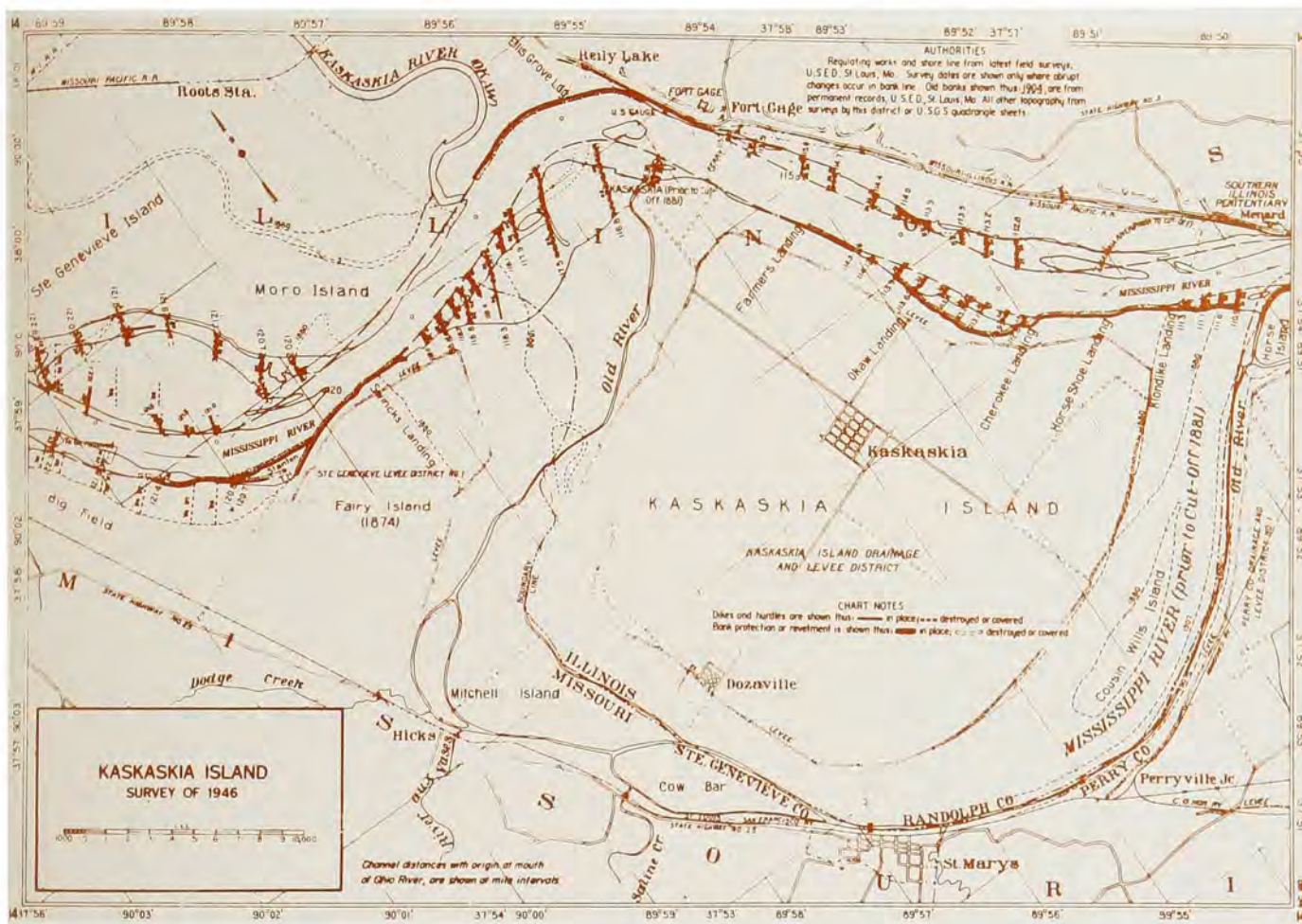
section to allow passage of ice and silt. Completion of Dam No. 27 assured a nine-foot pool from Chain of Rocks to Alton, and river traffic was guaranteed year-round accessibility to the Alton locks.⁸



The impact of river regulating works is dramatically reflected in these two surveys, which show the Kaskaskia Island area before and after the cut-off of 1881.

In addition to solving the problems posed by the Chain of Rocks, the St. Louis District also continued to build open river regulating works on the Middle Mississippi. A large backlog of needed improvements had accrued during the war, and in the years immediately after the war the District was involved in a flurry of new construction, building over a million dollars worth of new dikes and revetments in 1946 alone. The flood of 1947 provided impetus for additional Congressional appropriations, and Corps activities continued at a steady pace. But the outbreak of the Korean War in 1950 brought an abrupt halt to

new civil works construction in the District. In fact, the District underwent a reduction in force, so severe was the curtailment. Another reduction was scheduled, but it was canceled when the District was given a new mission in military procurement. This new mission involved procuring a wide variety of items, including prefabricated portable buildings, water purification equipment, and electric generators. This mission did not solve the problem of what to do with the engineering talent available in the District, however. As a result of the lack of new construction in the District, the engineering section was not being fully



utilized. The solution was to lend engineering expertise to other districts which still were faced with engineering problems, such as the Little Rock District (the same solution would be applied in the mid-seventies when a large amount of District construction was stopped by the courts). The procurement mission ended in 1954 along with the war. But the end of the Korean War, unlike the end of World War II, did not signal a new boom in construction of river regulating works, although levee construction did resume.

President Dwight D. Eisenhower, who took office

in 1953, clamped a tight lid on public works spending. Eisenhower was determined during his first administration to pursue conservative fiscal policies. As a result, navigation-related expenditures on the middle Mississippi plummeted from a high of \$12.6 million in 1950 to a low of \$1.9 million in 1956. From 1953 through 1956 not a single new revetment and only one new dike was constructed. It was not until 1959 that expenditures for regulating works would again reach the levels of the Truman years, and then only after Congress passed an appropriation over Eisenhower's veto. One result of this failure to maintain



Dikes that function properly, causing accretion of sand and restricting the channel of the river. Herculaneum, Missouri, is in the background.

construction levels or substantially to increase maintenance of existing dikes and revetments was that expenditures for dredging doubled during the Eisenhower years. As river conditions changed and new shoals were formed, dredging was the only option

the District Engineer had to insure maintenance of the nine-foot channel. During periods of low water, it was not uncommon to have two big dredges working 24 hours a day, seven days a week to keep the channel open to river traffic.⁹



Rip-rap being placed on banks to prevent erosion. In earlier days, rip-rap was placed by hand.



Modern river work includes the use of dynamite to remove rocks, as pictured here in the Thebes, Illinois—Commerce, Missouri, area. The dredge Keokuk is seen working at right.



The Engineer dredge *Fort Gage*, built in 1955.

Not only were appropriations for new works inadequate, but it was also “extremely difficult to get enough maintenance money.” The problem of maintenance was exacerbated by heavy ice flows in the winters of 1950-51 and 1957-58 and by floods in the spring and summer of 1951 which caused extensive damage to regulating works. Since appropriations were generally inadequate for even regular maintenance, this additional burden placed a strain on the resources and ingenuity of District personnel. One attempt to maximize the District’s limited resources was an innovation in dike construction. As piling became more and more expensive, the construction division of the District became one of the first in the country to experiment with stone dikes. The ready availability of stone along the middle Mississippi made stone dikes far more economical than pile dikes. During the fifties, new stone dikes (and the use of stones to repair or replace pile dikes) were increasingly common in the St. Louis District. Between 1945 and 1960, the total cost of navigation-related improvements in the St. Louis District, including operat-

ing and care of locks and maintenance, was over \$80,000,000; but the reluctance of the Eisenhower Administration to spend money on public works meant that the figure was much less than it might have been.¹⁰

While navigation projects could be postponed indefinitely, one area in which Congress and the administration could not shirk responsibility or disdain action was in flood control. All that was required was one disastrous flood; the likelihood of immediate Congressional and executive action on flood control projects would then increase markedly. St. Louis had several such floods during the years 1945-1960. In July 1947, St. Louis experienced its biggest flood since 1844 (the 1947 flood was subsequently almost equalled in June 1951). The combined Missouri-Mississippi flood of 1947 caused more damage than any previous flood in the history of the region. Early estimates placed direct damages at \$156 million and soil and crop losses at \$700 million. In addition, transportation and commerce also suffered large losses.¹¹



The flood of July 1947 was taken in stride by at least one resident of Jacob, Illinois.



As the river continued to rise in July 1947, many families like the Bradshaws of Jacob, Illinois, had to be evacuated.



Main Street in Hannibal, Missouri, inundated in June 1947 by the rising waters of the Mississippi.



Farmers were hit hard by the flood of 1947, including this resident of Grand Tower, Illinois.

St. Louis itself escaped extensive damage by the flood but the vulnerable river towns on the Illinois side of the river did not fair as well. Although Colonel Smyser brought in Army troops, jeeps, and amphibious vehicles to aid in the flood fight, the District was unable to prevent a certain amount of destruction. At Grand Tower, Illinois, the existing levee, even with sandbag reinforcement, was inadequate to stave off the rampaging river. What happened in that small community was typical of what happened in numerous other river towns. In preparation for the flood rolling down the Mississippi, residents moved their possessions to the upper floors, took their livestock to high ground, and kept sandbagging. When the levee was finally overtopped, everyone headed for high buildings like the school and the churches or for the small patch of high ground (about a city block) near the cemetery. There they stayed until the waters began to recede. The Coast Guard brought them supplies each day and the Illinois Department of Health vaccinated them for typhoid and smallpox. But beyond that the residents were helpless. They could do

nothing but wait for the river to return to its banks. The people of Grand Tower had been victimized by an unusually large flood on the one hand and an inadequate levee on the other. As one resident succinctly put it, "They're gonna have to have a new levee or I'm gonna leave town. Year after year, I been takin' this water in pretty good humor. But no longer. Either they build a levee, or I'm takin' to the hills."¹²

Ironically, the Flood Control Act of 1938 had authorized raising, enlarging, and extending the levees in the Grand Tower Drainage and Levee District, but work on the levees had been stymied by the failure of local officials to fulfill the local cooperation provision of the Flood Control Act. Three months after the disastrous 1947 flood, assurance of local cooperation was sent to the Division Engineer. When the next big flood came down the river in 1951, work on the reconstruction of the levees was over one-third complete. By 1959 the levee work was finished, at a cost of less than \$5 million.¹³

The flood of July 1951 did not cause as much damage along the Middle Mississippi as had the 1947 flood, in large part because the Corps had done over \$20 million worth of work on the levees, raising and strengthening them. Nevertheless, the flood did cause consternation and some substantial destruction. In West Alton, Missouri, water stood 3 to 4 feet deep on the lower floors of homes. Three months earlier, the upper Mississippi had been at flood stage and the small community of Portage des Sioux had been threatened by the rising river. The residents prayed that their village would be spared. It was, and in gratitude the citizens of the town erected a 26-foot Madonna on a 17-foot pedestal—Our Lady of the Rivers, which was illuminated at night to serve as a guide for river traffic. Each year a ceremony is held there blessing the boats that use the river.¹⁴

But Divine Providence was not nearly so reliable an ally in the battle against the flood waters as a strong levee system. The Flood Control Acts of 1936 and 1938 had authorized federal aid for such a system on the middle Mississippi, and during the years 1945-1960 it was substantially completed. The Corps designed and supervised the construction of levee work costing over \$75 million during those years. Nine levee projects were completed by 1960 (in addition to those completed prior to 1945), and five others were more than 75 per cent complete. Most of these levees were built on the Illinois side to protect the flood plain, since the Mississippi generally hugs the bluffs on the Missouri side, but there were several large levee projects on the western bank of the Mississippi, most notably at St. Louis and Cape Girardeau.¹⁵



Our Lady of the Rivers.



The completed Cape Girardeau floodwall.

Cape Girardeau's main business district was located on low ground which was subject to periodic flooding, disrupting commerce and causing considerable economic losses. The Flood Control Act of May 1950 authorized the Cape Girardeau Flood Protection Project, which provided for the construction of a series of earth levees and concrete flood walls designed to protect the low-lying areas against a flood of about 80-year frequency. The project, begun in 1956, resulted in the construction of over a mile of floodwall and almost half a mile of levee. The work was completed in 1964 at a cost of \$5,342,300.¹⁶

A location even more subject to inundation was on the Illinois side—East St. Louis and vicinity, an area of great industrial and commercial significance. Authorized by the Flood Control Act of 1936, the East St. Louis Flood Protection Project provided for "raising and enlarging the existing levee system by construction or reconstruction of 19.8 miles of levee, including 3.1 miles of floodwall." The goal of the project was to furnish protection against a flood of 200-year frequency. Construction on the East St. Louis levee and floodwall stretched over a thirty-year period, and ultimately cost over \$22 million, the most spent by the St. Louis District on any single levee project until the St. Louis Flood Protection Project. The East St. Louis levee provided protection for 111 square miles of business, industrial, and residential areas, as well as for the vast transportation network centered in East St. Louis.¹⁷



The Cape Girardeau Flood Protection Project proved its worth in the 1973 flood.



Colonel Fred E. Ressegieu
District Engineer, July 18, 1951-July 20, 1954.



Colonel Charles B. Schweizer
District Engineer, September 1, 1957-July 21, 1960.



Colonel George E. White, Jr.
District Engineer, July 1, 1954-May 31, 1957.

Technological developments during these years meant a change in the way the District operated. One noteworthy development was the use of the helicopter. The first District Engineer to consider using helicopters was Colonel Fred Ressegieu (who was known as "the boy colonel" because he looked so young). He made arrangements in 1953 to observe future floods on the Mississippi and Illinois Rivers using four privately-owned helicopters. Under this plan, the helicopters would be used only in the event of severe flooding. However, Colonel Charles B. Schweizer was responsible for integrating helicopters into the normal routine of District operations through an arrangement with the Army Transportation Corps in St. Louis. Helicopters were used for reconnaissance of the rivers and inspection of construction sites. Colonel Schweizer flew around the District so frequently that he became known as "Chopper Charlie," and one young Lieutenant remarked during a flight that no one was safe from an unexpected visit by the Colonel.¹⁸



—Missouri Historical Society

Downtown St. Louis looked much the same in 1955 as it had in the 1930s.

A more important application of technology came in the fifties with the utilization of computers for both business and engineering purposes. Because of a serendipitous circumstance, the St. Louis District was one of the first to have access to a computer. In 1949, the Engineer Supply Control Office (the Engineers' predecessor to the Army Materiel Command), moved its headquarters to St. Louis. Its personnel and accounting functions were assigned to the St. Louis District office, and, as a result, when ESCO acquired a computer (an IBM 650), District personnel had access to it (mostly at night) for both business and engineering uses. In 1962, the District obtained its own computer (an RCA 301), which was used until 1974, when the District switched over completely to the terminal system (some terminals were being used as early as 1970). These computers not only enabled the St. Louis office to occupy the vanguard among districts in the changeover to automatic data processing for business and administrative purposes, but they also allowed the engineering division to identify opti-

mum specifications for new structures, assuring both safety and economy.¹⁹

Flood control had replaced navigation as the primary focus of the civil works of the Corps of Engineers in the years after the Flood Control Act of 1936. The Acts of 1936, 1938, and 1944 had established the broad parameters of Corps' activities in flood control, and only minor changes occurred in the postwar years. In 1954, the Small Watershed Protection and Flood Prevention Act "terminated the jurisdictional rivalry between the Soil Conservation Service and the Corps of Engineers by assigning upstream flood control (creek and headwaters areas) to SCS and downstream flood control (mainstreams and major tributaries) to the Corps." In 1958, a conference was held on flood problems which would have considerable influence on Corps' thinking regarding flood plain management. Ultimately the results of this conference would lead the Corps to establish a flood plain information studies program.²⁰



In 1940 the WPA began construction of the Devil's Kitchen Dam in Illinois for the Interior Department. In 1943 work was discontinued because of the war effort. Until 1957, the two pillars stood as lonely reminders of the dormant project. In that year the Corps of Engineers resumed construction, completed the dam in 1959, and turned it over to the Bureau of Sport Fisheries and Wildlife of the Interior Department.



But the major activities of the Corps continued to stem from the seminal Acts of 1936, 1938, and 1944. In St. Louis this activity took the form of levee construction, primarily, although the District was also involved in examinations provided for in the Flood Control Act of 1938, which called for a general comprehensive plan for flood control in the upper Mississippi River basin. In addition to levee construction, the plan called for preliminary examinations of possible reservoir sites on the tributaries. Planning done during the mid-fifties would provide the District with a number of construction projects to pursue during the sixties. Much of this planning was done during the tenure of Colonel George E. White, Jr., a hard-working, serious-minded District Engineer who, according to one employee, "didn't always frown—sometimes he scowled." But he also motivated his staff to accomplish a great deal of work. In the St. Louis District the sites examined included Meramec, Union, and Cedar Hill on the Meramec River; Carlyle on the Kaskaskia River; and Joanna on the Salt River. The Carlyle reservoir was the first to be authorized, in the Flood Control Act of 1958. The act further provided for a reservoir at Shelbyville, also on the Kaskaskia River.²¹

The period after World War II was a transitional one for the District; by the late fifties the focus of its construction activities began to shift from the Mississippi to its tributaries. The decade of the sixties would witness a boom in large dam construction on the tributaries as the last of the levee projects on the middle Mississippi was completed. This boom would mean both greater visibility and greater controversy for the St. Louis District. But in 1960 the future looked rosy indeed. The St. Louis area was recovering from a business slump and seemed on the verge of an economic renaissance. Likewise, the St. Louis District of the Corps of Engineers had undertaken a number of large projects in the late fifties (including the St. Louis Flood Protection Project, the Carlyle Reservoir, and the Shelbyville Reservoir) which seemed likely to keep the District busy in coming years. Thus there was little reason to suspect that the future would find the District squarely in the eye of a storm of controversy in which its honesty was impugned, its good intentions called into question, and its self-definition as servant of Congress and the people derided. In 1960 both the St. Louis District and the city had good reason to view the future with optimism and anticipation.

Footnotes Chapter 6

1. Fred K. Vigman, *Crisis of the Cities* (Washington, D.C., 1955), 130-31; Ted Schafers, "St. Louis; 71,800 Jobless," *The Nation* 186 (April 5, 1958), 293-94; "A New St. Louis Rips Up Its Past," *Business Week* (September 10, 1955), 130-34; "The 'New' St. Louis," *Newsweek* 66 (November 15, 1965), 123; *St. Louis Globe-Democrat* (February 29-March 1, 1964), 4M; Robert I. Vexler, ed., *St. Louis: A Chronological and Documentary History, 1762-1970* (Dobbs Ferry, N.Y., 1974), 61-64.
2. Willard Price, "The Upper Mississippi," *National Geographic Magazine* 114 (November 1958), 659, 672; Harry M. Hagen, *This Is Our St. Louis* (St. Louis, 1970), 574, 576; *St. Louis Post-Dispatch* (February 16, 1964), 16M; *St. Louis Globe-Democrat* (February 29-March 1, 1964), 12M.
3. Hagen, *St. Louis*, 576; Price, "Upper Mississippi," 672; F. E. Ressegieu, "The Chain of Rocks Canal," *The Military Engineer* 45 (March-April 1953), 128-30; P. S. Reinecke, "Proposed Improvement of the Mississippi River at Chain of Rocks," speech delivered to the Engineers' Club of St. Louis, November 2, 1939, Record Group 77, Federal Records Center, Kansas City.
4. Ressegieu, "Chain of Rocks," 128; "Chain of Rocks Reach," 1933, Record Group 77, Federal Records Center, Kansas City; U.S. Congress, House, *Mississippi River between Ohio River and Mouth of Missouri River*, H. Doc. 76-231, 76th Congress, 1st Session, 1-47, 1939; *Annual Report of the Chief of Engineers, 1939*, 1114-15; *Annual Report, 1945*, 1220; Clark Kittrell, "Navigation Improvement at Chain of Rocks," *The Military Engineer* 40 (December 1948), 556-58; Colonel Rudolph E. Smyser, Jr., to author, August 23, 1976. In 1954 the Upper Mississippi Valley Division was eliminated in an effort to streamline the organization of the Corps. At that time the St. Louis District became the northernmost district of the Lower Mississippi Valley Division (even though the middle and upper Mississippi have little in common with the lower Mississippi).
5. Ressegieu, "Chain of Rocks," 128-30; Kittrell, "Navigation Improvement," 557; interview with Lowell Oheim (former Chief of Construction, St. Louis District), July 1976.
6. Ressegieu, "Chain of Rocks," 128-30.
7. U.S. Army Engineer District, St. Louis, *Environmental Statement, Mississippi River between Ohio and Missouri Rivers (Regulating Works)*, (St. Louis, 1976), 48; *Annual Report, 1959*, 640-41; *Annual Report, 1964*, 596.
8. Alfred J. D'Arezzo, "Chain of Rocks Across the Mississippi," *The Military Engineer* 54 (May-June 1962) 185-87; *Mississippi River between Ohio and Missouri*, 48.
9. *Annual Reports, 1945-1960*; John Furman Wall, "The Civil Works of the United States Army Corps of Engineers: Program Modernization," (unpublished Ph.D. dissertation, Cornell University, 1973), B81; interview with Homer Duff, District Comptroller and long-time employee, July 1977; interview with Max Lamm, July 1977; *St. Louis Post-Dispatch* (December 6, 1953), 2.
10. Interview with Lowell Oheim, July 1976; *Annual Report, 1951*, 1183; *Annual Report, 1958*, 614. See also Charles A. Wilkerson, "Stone Dikes for River Channels," *The Military Engineer* 64 (March-April 1972), 96-100; *Annual Reports, 1945-1960*.
11. U.S. Congress, Senate, *Flood Protection for St. Louis, Mo.* S. Rep. 84-1092, 84th Congress, 1st Session, 2, 1955; U.S. Congress, House, *Providing for the Improvement of the Mississippi River at and in the Vicinity of St. Louis, Mo., for Flood Control*, H. Rep. 84-1459, 84th Congress, 1st Session, 2, 1955; "Ruin by the River," *Business Week* (July 19, 1947), 22.
12. Interview with Max Lamm, July 1977; "Duck Drownder," *Time* 50 (July 14, 1947), 19.
13. *52 Statutes at Large*, 1215; *Annual Report, 1947*, 1361-62; *Annual Report, 1951*, 1196-97; *Annual Report, 1959*, 649-50.
14. "Roll, Mississippi," *Newsweek* 38 (July 30, 1951), 16; Roald Tweet, *A History of the Rock Island District, Corps of Engineers* (Rock Island, Ill., 1975), 124; Price, "Upper Mississippi," 693.
15. *Annual Reports, 1945-1960*. Levees completed during this period (and their cost) included the Chouteau, Nameoki, and Venice Drainage and Levee District in 1954 (\$185,440); Miller Pond Drainage District in 1955 (\$164,052); North Alexander Drainage and Levee District in 1957 (\$939,202); Harrisonville and Ivy Landing Drainage and Levee District No. 2 in 1957 (\$4,362,588); Fort Chartres and Ivy Landing Drainage District No. 5 in 1958 (\$1,149,912); Columbia Drainage and Levee District No. 3 in 1958 (\$2,819,834); Grand Tower Drainage and Levee District in 1959 (\$4,661,311); Degognia and Fountain Bluff Levee and Drainage District in 1959 (\$5,873,902); and Prairie Du Rocher and vicinity in 1959 (\$3,871,321). Levee projects still under construction in 1960 and the percentage of work completed were as follows: Cape Girardeau (80%), Clear Creek Drainage and Levee District (88%), Perry County Drainage and Levee Districts Nos. 1, 2, and 3 (75%), Wilson and Wenkel and Prairie DuPont Drainage and Levee Districts (99%), Mississippi River at St. Louis (4%), East St. Louis and vicinity (58%), and Wood River Drainage and Levee District (78%).
16. *64 Statutes at Large*, 175; *Annual Report, 1951*, 1190; *Heritage on the Mighty Mississippi* (U.S. Army Engineer District, St. Louis, n.d.), 66. The St. Louis flood protection project will be discussed in the following chapter.
17. *Heritage on Mississippi*, 67; *Annual Report, 1967*, 612-13.
18. Colonel Charles B. Schweizer to author, September 1, 1976; interview with Homer Duff, July 1977; *St. Louis Post-Dispatch* (April 12, 1953), 14A. Colonel Schweizer's family had an unusually long relationship with the District. His father was an employee of the Mississippi River Commission from 1907 to 1956, ending his career in the position of assistant to the President of the MRC. The Colonel's son worked in the District's computer section in 1969, before being called into active military service.
19. Interview with Homer Duff, July 1977; interview with Thomas Mudd, July 1977; interview with Arthur Johnson, July 1977; *St. Louis Post-Dispatch* (July 9, 1957), 6A.
20. Wall, "Civil Works," B92-93; *68 Statutes at Large*, 668.
21. *Annual Report, 1954*, 728-29; *72 Statutes at Large*, 310; *Annual Report, 1959*, 660-61; interview with Lester Arms, July 1977; interview with Elmer Huizinga, July 1977. The Carlyle and Shelbyville projects will be discussed in the following chapter.



Coal barges locking through on the Kaskaskia River.



Old Problems and New Priorities

The period of 1960-1976 was one of the most turbulent in American history—an era marked by civil rights agitation, assassinations, race riots, Vietnam, oil shortages, and Watergate. Yet the early sixties gave no hint of the tribulations to come. Rather, it was a time of optimism and hope, a time when most Americans believed that no problems were beyond solution. After all, the standard of living was higher in the United States than in any other country in the world. All that was needed was hard work, ingenuity, and money—all of which America possessed in abundance—and problems would melt away. But this mood would change radically during the tumultuous years that followed, and by the late sixties some Americans began to pose quality of life and standard of living as possibly antithetical. Environmentalists in particular questioned whether the future offered an unlimited prospect of progress as most Americans had assumed, and even whether material progress was necessarily a positive good. This abstract issue would find concrete representation in the St. Louis District during these years, raising questions about economic development versus environmental preservation and calling for reassessment of many Corps of Engineers activities.

But in the early sixties, the St. Louis District was riding a crest of renewed public works spending under the Kennedy administration. Furthermore, the virtual completion of the levee system along the middle Mississippi, combined with the series of big dams being planned and built on the tributaries, seemed to offer the potential for efficient and effective flood control.

Inhabitants of the St. Louis District would be safer from the ravages of the river than they had ever been before. Man was winning his battle against the destructive forces of nature—or at least so it seemed until 1965. In that year, one of the worst floods in history struck the upper Mississippi. A combination of melting winter snow and heavy spring rains raised the river to near record heights. Although a series of flood control dams on the Missouri River held back its waters, minimizing damage to St. Louis and points south, on the upper Mississippi thousands of acres were inundated. An even larger dose of what nature could do to test man-made structures would come in 1973 when the greatest flood in history hit St. Louis.

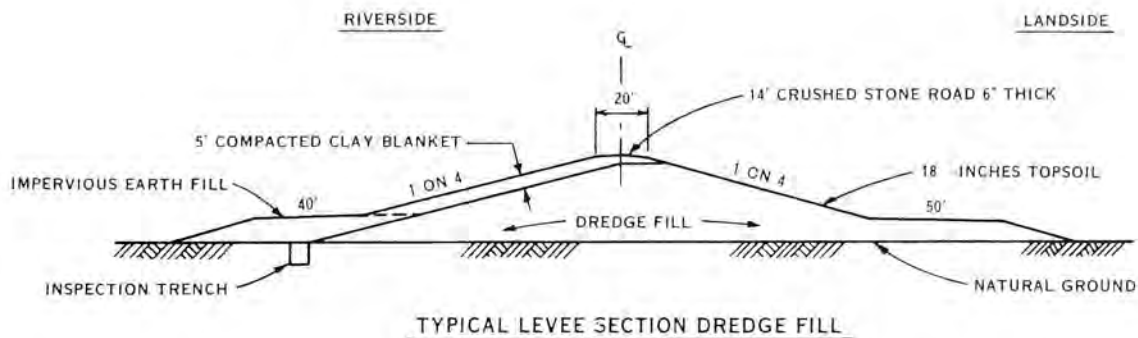
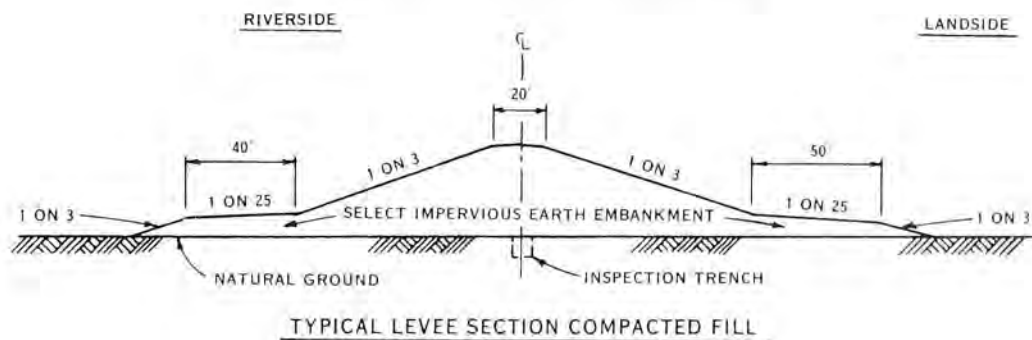
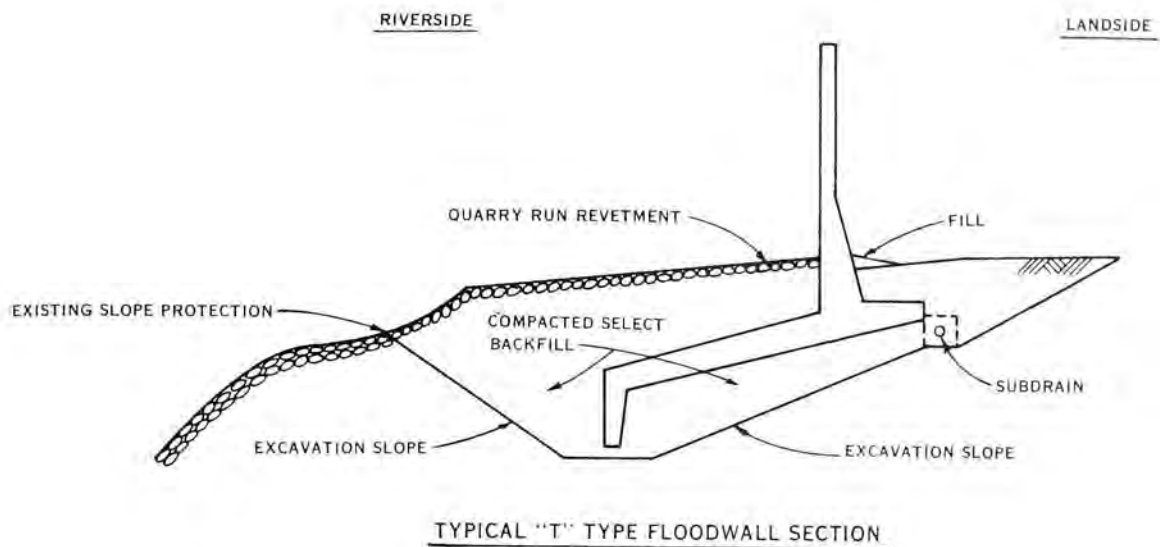
Effective flood damage prevention in the St. Louis District assumed the successful prosecution of a number of new projects. One of the most significant was the St. Louis Flood Protection Project. Although the early settlers in St. Louis had wisely chosen the high bluffs along the Mississippi for their settlement, over the years industrial and population areas had developed in the flood plain fronting the bluffs. Furthermore, the levee system had resulted in a rise in flood levels at St. Louis because the levees constricted the river during floods. The result was that St. Louis had become increasingly vulnerable to property damage from flooding. One source predicted that “a recurrence of the 1844 flood would put some parts of Broadway under water and cost the city an estimated \$316,000,000.” Lesser floods had cost millions of dollars in damages in recent years. Surprisingly, St. Louis remained the only major city on a navigable stream without flood protection. Thus in 1955, Congress authorized construction of eleven miles of levees and flood walls to protect St. Louis. Construction began in 1959 and was virtually complete in 1974.¹

The combination flood wall-levee was designed to provide protection against a flood height of 52 feet on the St. Louis gauge. The specifications for the flood-wall were arrived at with the aid of a computer, marking the first important use of the computer in engineering design in the District. The computer so increased the ability of the structural engineers to plan



St. Louis Flood Protection Project.

for optimum design that the floodwall project, which was originally budgeted for \$130 million, was completed at a cost of \$86 million. One reach of the system extended from Maline Creek, the northern city boundary, to near the Gateway Arch; the second



reach began south of the Gateway Arch and extended southward to the high ground at Chippewa Street. The project consisted of four miles of levee and seven miles of floodwall—levees were used where feasible, but in complex, densely-occupied areas concrete floodwalls were built. While offering protection from the river, the flood wall-levee system also presented drainage problems—if it kept water out, it would also keep water in. Thus water had to be passed through or over the walls to assure adequate interior drainage.

To allow for this requirement, the Engineers had to alter 44 sewer systems and build 28 pumping stations (the latter pumped water into the river when normal storm water sewer flow was blocked by high river stages). Even before the finishing touches had been applied to the project, it would prove its value.²

The project was nearing completion at a propitious time in 1973, for in April of that year the middle Mississippi experienced the highest flood in recorded history. In 1844 the Mississippi had reached a flood stage



Portion of the St. Louis floodwall, as it appears normally and during the 1973 flood.



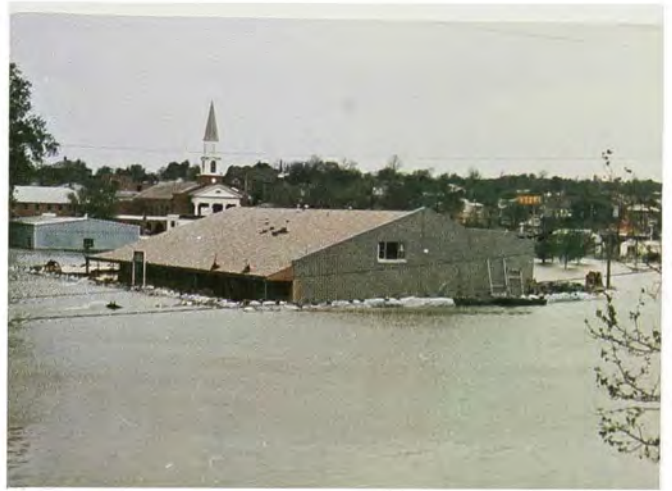
of 41.3 feet. In 1785, it has been estimated, the river reached 42 feet. But on April 30, 1973, it rose to 43.3 feet. Fortunately for local citizens and businesses the East St. Louis Flood Protection Project had been completed several years before and the St. Louis Project was nearing completion—only one section was incomplete and it was quickly filled with earth (covered with sheet plastic) to hold the waters back. Both systems held. But while the St. Louis area was protected, river towns above and below St. Louis were hit hard by as many as six different flood crests between March 9 and May 25, a record-setting 77 straight days above flood stage.³

Grafton, Elsberry, Portage des Sioux, West Alton, River des Peres, Arnold, Chouteau Island, and Kaskaskia Island all suffered heavy flood damage. The island of Kaskaskia disappeared completely under the river, like “a latter-day Atlantis,” despite the best efforts of St. Louis college students and inmates from Illinois’ Menard State Prison who together helped Corps’ personnel in their attempt to raise the levees. State police sealed off Grafton, Illinois, when the combined flood waters of the Mississippi and Illinois inundated 80% of the town. A power plant upstream of Alton was completely surrounded by water; employees had to be flown in and out by helicopter. While the federally-constructed levees held throughout the District, areas not protected by federal levees and areas along the tributaries suffered consider-

able damage. Private levees not built to Corps’ specifications (primarily on the upper Mississippi) were no match for the massive flood waters. Land along the tributaries was flooded because of an unfortunate side effect of the levee system—by constricting the waters of the Mississippi and refusing the river access to the natural flood plain, the levees forced the flood stages higher, causing water to back up on the tributaries and resulting in some flooding along those streams. Along the Meramec River, 2000 homes were inundated; on the River Des Peres, 150 homes were damaged (in some cases because residents removed sandbag levees prematurely). In an effort to shore up existing levees and provide new temporary protective levees, the District distributed over six million sandbags. Corps personnel and volunteers worked around the clock during the most crucial days of the flood.⁴

But the flood was simply too massive to be denied in every instance. An estimated 1,800,000 acres were flooded in Missouri and Illinois, and over 3000 families were forced from their homes. An additional secondary effect of the flood was to halt barge traffic between St. Louis and Muscatine, Iowa. Locks No. 24, 25, and 26 were out of commission because the Engineers had removed the electric motors to protect them from possible flood damage. Total damages within the District were estimated at \$136,000,000; without flood protection, it has been estimated that damages might have exceeded \$1 billion.⁵

Flooding south of St. Louis in 1973 is vividly illustrated by these before and after pictures.



West Alton, Missouri, was hard hit by the flood of 1973.

The improbable had happened. The Mississippi, Missouri, and Illinois Rivers crested simultaneously. More than six million gallons of water per second were flowing past St. Louis even before the crest was reached. Ultimately, the flow would reach an estimated 6.4 million gallons per second (compared to the average flow of 1.3 million gallons per second). However, the St. Louis District had one other advantage in its flood fight in addition to the levee system. In February 1973, in anticipation of major spring flooding, Major General Charles C. Noble, President of the Mississippi River Commission, called for a valley-wide flood fight exercise. It was "devoted to rehearsing working staffs and key field personnel in the activities they would be expected to perform in an actual flood emergency." Only two weeks after its conclusion, the real flood fight began.⁶

Another major flood control project undertaken by the Engineers in the late fifties was the first of the major reservoirs in the St. Louis District, Carlyle Lake, on the Kaskaskia River in Illinois. The Kaskaskia River flows 325 miles from its origin in Champaign County, Illinois, into the Mississippi River above Chester, Illinois. The drainage basin covers 5840 square miles in southwestern Illinois, an area where agriculture is the major industry. The relatively sparse population within the basin of 222,300 in 1970 reflected the rural character of the Kaskaskia valley. The projects at Carlyle and later at Shelbyville represented an effort not only to provide an adequate water supply for rural needs, but also a desire on the part of local interests to stimulate the economy by attracting industry and by providing recreation. The economy of the area had been relatively stagnant and population was actually declining in most counties in the basin. These new lakes might provide the im-

Prior to completion of Carlyle Lake, the area was explored and excavated by a team of archaeologists from Southern Illinois University. The remains unearthed indicated that the area had been occupied by various groups for an estimated 6200 years.





Carlyle Dam and Lake.

petus to reverse that trend.⁷

Flood control was also an essential rationale for the new reservoirs on the Kaskaskia. At Vandalia, Illinois, the river overflowed its banks an average of four times a year. Between Shelbyville and the river's confluence with the Mississippi, the average annual flood damages were estimated to be \$1,270,000. The idea of reservoirs on the Kaskaskia was not new. Carlyle Lake had originally been authorized as a unit of the general comprehensive plan for the upper Mississippi River Basin under the Flood Control Act of 1938. In 1958 Carlyle Lake was removed from the upper Mississippi River Basin plan and reauthorized as a separate project, along with a reservoir at Shelbyville (also on the Kaskaskia), levees along the Kaskaskia, and flood protection at New Athens, Illinois. Construction of the Carlyle Dam began in November 1958 and was completed in the summer of 1967. The dam was designed to impound up to 700,000 acre feet of water for flood control purposes.⁸

The Carlyle dam was built as a compacted earth-fill dam with a 179-foot concrete spillway section, surmounted by four 38-by 39-foot Tainter gates. The surrounding topography presented special problems and it became necessary to construct two earth-fill saddle dams east of Carlyle to contain the reservoir. Another problem was the relocation of facilities within the reservoir area. In addition to moving highways, railroad tracks, pipe lines, and sewer lines, the workers even had to relocate several cemeteries. But the end result was a reservoir which attracted 2,500,000 visitors in 1973 (it provided the nearest flat-water recreation for metropolitan St. Louis except for the Alton pool), which reduced flood crests on the Kaskaskia by as much as 5.8 feet during the great flood of 1973, and which would help assure a nine-foot channel for navigation on the Kaskaskia. In addition, the project provided for fish and wildlife conservation, water supply, and downstream water quality control.⁹



Carlyle Lake has become a focal point for recreational activities since its completion.

Construction of the Shelbyville Dam and Reservoir, also provided for by the Flood Control Act of 1958, was begun in April 1963. Shelbyville was the first dam completely designed and constructed by the District (Carlyle had been designed in the Upper Mississippi Valley Division office). The dam was to be located 222 miles above the confluence of the Kaskaskia with the Mississippi River and 115 miles above Carlyle Dam. The project called for a compacted earth-fill dam 3000 feet long, with a concrete spillway structure containing three 45- by 37-foot Tainter gates. The dam, with a maximum storage capacity of 684,000 acre feet, was completed in 1970, despite the necessity of coping with an unusual construction problem. Under the area designated for location of the 384-foot concrete spillway were a number of abandoned coal mines at shallow depths. Some of these mines were "bootleg" mines, excavated during the Depression by local residents who needed fuel. Since the residents usually did not own the mineral rights, these mines were illegal, and their existence remained a local secret. Even those mines which were legal had been operated only sporadically, and because they were small and only marginally profitable, no records of their existence had been maintained. It was therefore necessary to drill borings to locate the mines and determine their limits. Then "a complex program of low-pressure grouting was evolved to fill the mines, providing both roof support and a seepage barrier."

The problem was solved, construction was completed, and the final result was Lake Shelbyville, designed to provide local flood control, water supply, water release for navigation on the Kaskaskia River Navigation Project, fish and wildlife conservation, and recreation. In 1976, the lake was visited by approximately 3,000,000 people who came to take advantage of its recreational facilities.¹⁰

Although some Corps' projects met resistance from environmental groups, one area in which that was not the case was on the Big Muddy River in Southern Illinois. In fact, local interests formed the Rend Lake Conservancy District in 1955 to seek actively the construction of a reservoir on the Big Muddy. The local economy, largely dependent on coal mining and agriculture, had been in a state of decline for a number of years because of the increasing mechanization of coal production. New industries had been reluctant to locate in this region of Southern Illinois because of the shortage of water. In addition, the loess soil in this area absorbs very little rainfall, with the result being a heavy runoff during spring rains, causing severe flooding. Furthermore, since the soil does not absorb much moisture, it dries out quickly during



One of the three 45 x 49 foot Tainter gates being installed in the spillway section of the Shelbyville Dam.

Lake Shelbyville.

One of the swimming beaches at Lake Shelbyville.



the summer, making it unsuitable for agriculture, despite 40 inches of annual precipitation. Thus the Conservancy District was formed and began to lobby for a dam on the Big Muddy. Congress responded by authorizing the Rend Lake project in the Flood Control Act of 1962. Preconstruction planning was com-

pleted in 1965 and construction was started on two subimpoundment dams on the upper arms of the reservoir to enhance the fish and wildlife value of the project. They were completed in 1966; construction of the main dam started in 1968 and was completed in 1972.¹¹

The Big Muddy River is located in southern Illinois; it rises in Jefferson County, Illinois, and empties into the Mississippi near Grand Tower, 155 miles later. The Rend Lake Dam was located about three miles northwest of Benton, Illinois, 103 miles above the confluence of the Big Muddy with the Mississippi. The project provided for an earth dam with an ungated concrete spillway. The dam, over a mile long, would impound up to 294,000 acre feet of water. In return for the Federal cost of \$44,700,000, the new reservoir furnished a water supply of some eleven million gallons a day to 64 local communities, as well as providing flood control, low-flow regulation, and recreation and fish and wildlife conservation to stimulate tourism. In 1976 Rend Lake was visited by over 2,100,000 people.¹²

The first multipurpose dam built on the Missouri side of the Mississippi was also the first multipurpose project in the St. Louis District to include hydroelectric power. The Clarence Cannon Dam and Reservoir (identified as the Joanna Reservoir until 1965) was to be built near Joanna, Missouri, about 63 miles above the mouth of the Salt River. The Salt flows through northeastern Missouri, rising 12 miles south of the Missouri-Iowa state line in Schuyler County. There are no major cities within the 3000-square mile drainage basin of the Salt; the population of the entire area in 1970 numbered only 105,400. Agricultural areas in the basin (farming was the mainstay of the local economy) were subject to periodic flash floods, averaging one a year. No Federal flood protection measures had been taken prior to construction of the Clarence Cannon Dam and Reservoir. Levees had been considered, but the valley was so narrow that Federal levee construction was not justifiable on economic grounds. Smaller reservoirs on two of the tributaries (the North Fork and the South Fork) were examined and rejected on economic grounds. Finally the decision was made to construct a large dam on the Salt itself.¹³

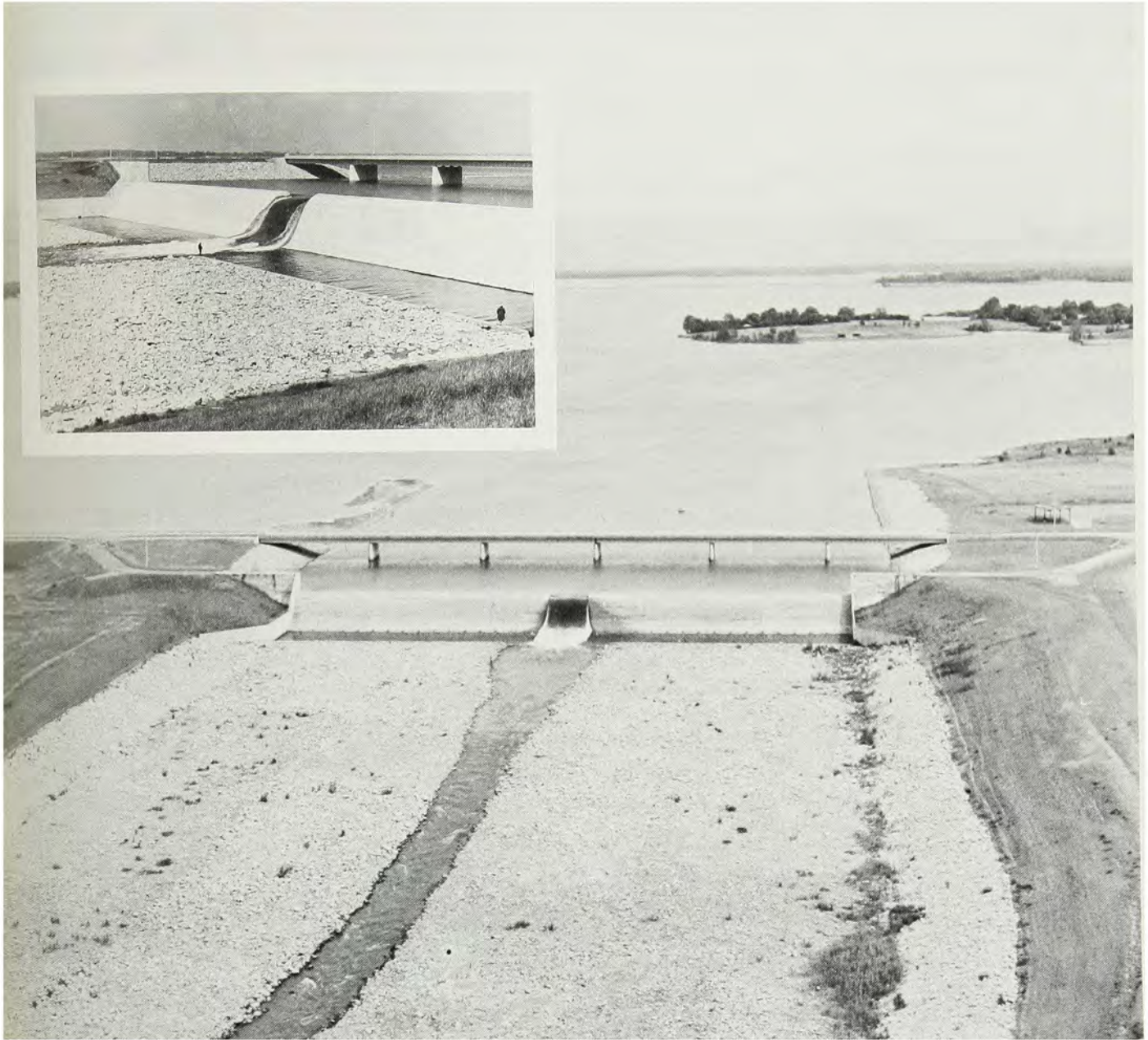
The project was originally authorized by the Flood Control Act of 1938. But, as in the case of the Carlyle Reservoir, no action had been taken except for preliminary surveys, and in 1962 it was deleted from

BIG MUDDY RIVER BASIN ILLINOIS



the upper Mississippi River Basin project and was re-authorized as a separate project. Preconstruction planning took place between 1963 and 1966, and construction began in 1971. The project was scheduled for completion in 1981.¹⁴

The Joanna Reservoir had been renamed in 1965 in honor of Clarence Cannon, a member of the United States House of Representatives from 1922 until his death in 1964. During part of that period he was chairman of the House Appropriations Committee. Throughout his long tenure in the House, Cannon was able to assure the state of what he considered its fair share of public works spending. It was fitting that the project should be named for Cannon, who had lived in Elsberry, Missouri, only a short drive from the new



Rend Lake.

dam and reservoir, and who had done so much to procure certain public works projects for Missouri.¹⁵

Because the Cannon project included the generation of hydroelectric power—as well as flood control, water supply, fish and wildlife conservation, recreation, area redevelopment, and navigation—it called for somewhat different construction needs than the Illinois dams. First, of course, it required construction of power generators—in this case, one 31,000 kilowatt reversible unit and one 27,000 kilowatt conventional unit. Second, to assure sufficient flow for power generation during periods of low water, a re-regulation dam was to be built 9-1/2 miles downstream to store released water for pumpback operations. This dam would be 1550 feet long, 38 feet high, and have two 30- by 31-foot Tainter gates (as compared to the main dam which would be 1940 feet long, 138 feet high, and have four 50- by 39-foot Tainter gates). With completion scheduled for 1981, local interests in the Cannon Dam area were already expressing optimism in 1976 that the new abundance of water and power would lead to an economic boom for their region.¹⁶

Building large reservoirs in the District placed an increased burden on two areas of District activity—real estate acquisition and recreation development. The real estate division had the responsibility for acquiring the land needed for the project, and in the case of the reservoirs a great deal of land was required. Any time a governmental agency purchases a large amount of land from a number of different owners, some owners will be displeased with having to sell or with the amount of compensation. But under the leadership of Elmer Huizenga (head of the real estate division, 1951-1973), the St. Louis District had the best record of amicable settlements during the 1950s and 1960s of any District in the Corps. Once the land was acquired, development of recreational facilities began. The first (and sometimes only) thing that many people noticed about the reservoirs was their recreational uses such as boating, swimming, fishing, picnicking, hiking, camping, and sight-seeing. Thus the comprehensive and imaginative development of these recreational features became an important part

of the Corps' public image and of the District's service to its constituents.¹⁷

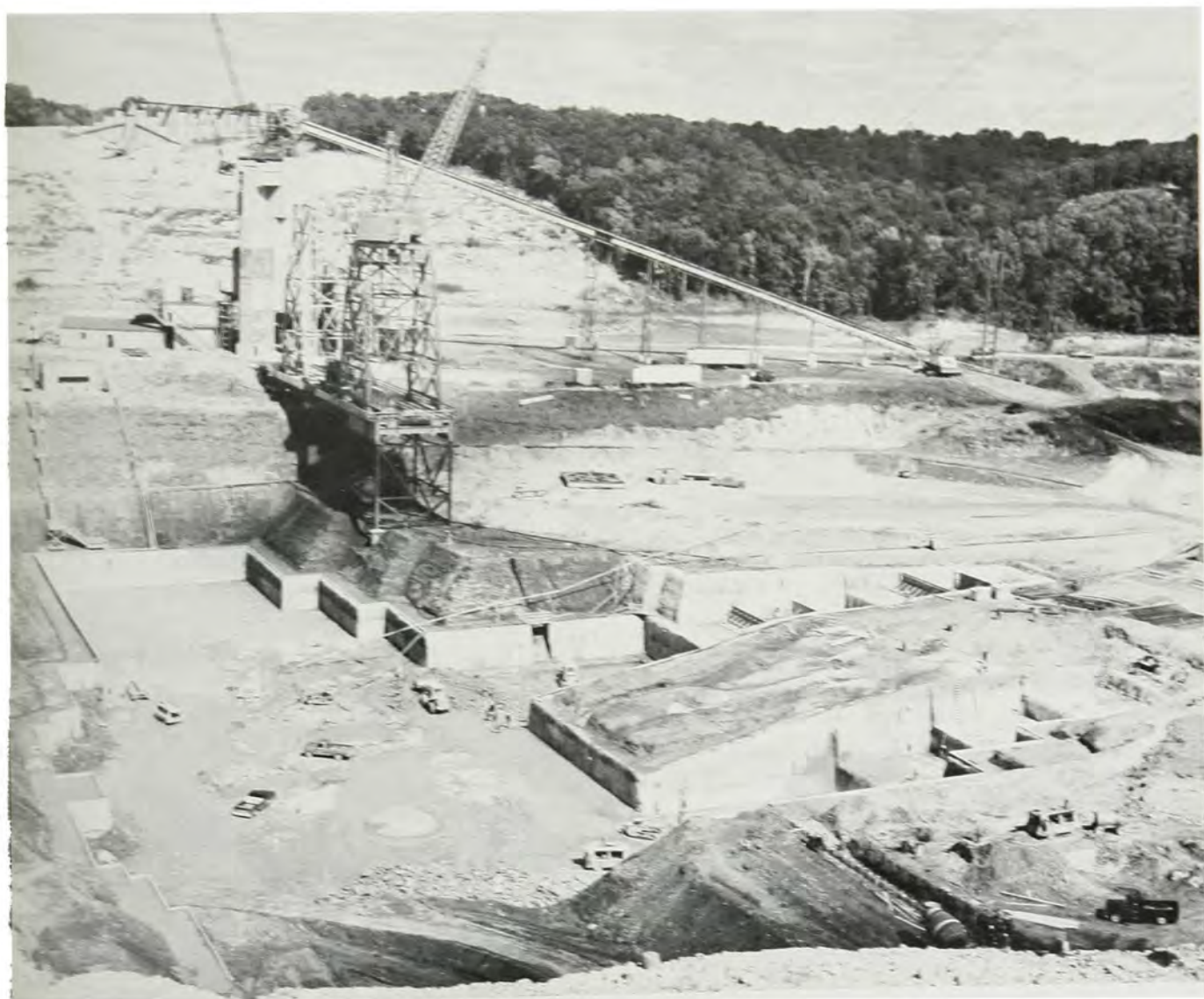
The St. Louis Flood Protection Project, Carlyle Dam, Shelbyville Dam, Rend Lake Dam, and Clarence Cannon Dam comprised the major undertakings of the St. Louis District during the sixties, and, by and large, these projects had been prosecuted with the general approval of the public. But two new projects which belonged primarily to the decade of the seventies would plunge the St. Louis District into the center of the environmental controversy—the Meramec Park Dam and the replacement of Locks and Dam No. 26 at Alton. These two proposed Corps' projects would serve as a rallying point for conservationists and preservationists who saw these undertakings as contrary to the best use of the natural environment.

The Meramec River rises in Dent County near Salem, Missouri, and travels in a northeasterly direction for about 330 miles before emptying into the Mississippi, at St. Louis. The Meramec Basin has an area of slightly less than 4000 square miles; within the basin are some of Missouri's most scenic areas, including forests, caves, natural springs, hills, and valleys. Except for the St. Louis area at the mouth of the Meramec, the basin is sparsely populated. Nevertheless, flood damages in the basin had averaged about two million dollars a year. The possibility of building a dam on the Meramec River had been considered as early as 1934, but was rejected because at that time the dam was considered uneconomical in terms of its potential for flood control. An Engineer study found that local flood damages amounted to only \$50,000 a year and that flood control benefits on the Mississippi would amount to a maximum reduction in the flood stage at Cairo of 0.3 foot. Nor was the proposed reservoir found to present any economically justifiable benefits from navigation, water power, or irrigation. However, a flood in the spring of 1935 caused an estimated \$163,000 damage to the local area, thus leading to a reassessment of the Meramec situation.¹⁸

The Flood Control Act of 1938 proved a landmark piece of legislation for the St. Louis District. It ap-

proved a general comprehensive plan for flood control and other purposes for the upper Mississippi River basin. This plan anticipated the construction of levees on the main streams and reservoirs on the important tributaries. The potential reservoirs to be examined and reported on in the St. Louis District were the Meramec, the Big River, the Carlyle (Kaskaskia River), and the Joanna (Salt River). Detailed

plans were prepared for each of the projects during the decades that followed, although the first of these reservoirs was not begun until twenty years later. The report on the Meramec Basin was completed in 1949. It called for construction of three dams—on the Meramec, the Bourbeuse, and the Big Rivers. At that time the plan was deferred for further study when the proposal was not accepted by the State of Missouri.¹⁹



Construction of the Clarence Cannon Dam.



Colonel Alfred J. D'Arezzo
District Engineer, August 1, 1960-May 1, 1963.

But in 1958, Missouri Governor James F. Blair, Jr., asked the District Engineer to update the Meramec Basin plan. In response to that request the House Committee on Public Works directed the Corps of Engineers to restudy the project. Most of the restudy was done during the tenure of Colonel Alfred D'Arezzo, who was District Engineer from 1960 to 1963. Hearings were held throughout the Meramec Basin to allow residents to ask questions and express their views. Even during this early period, environmentalists made their presence known. A representative of the group Friends of the Earth appeared at every meeting and sat in the front row, trying, as D'Arezzo later recalled, "to ask questions that I couldn't answer or for which there were no answers." If ever there was a District Engineer to accept challenges, though, it was "Big Al." He had a reputation as one of the toughest and most demanding officers ever to preside over the St. Louis District. He was remembered by one employee as a "workaholic." As a result, more work was accomplished during his tenure than during any previous officer's stay in St. Louis, according to a



The location of projects proposed for the comprehensive development of the Meramec Basin.

study done after his departure.

D'Arezzo inspired a certain amount of awe and not a little trepidation among the District staff. Such reactions would undoubtedly have been heightened had they known more about his background (concerning which he was very modest). At the outbreak of World War II he was stationed in the Philippines, and after several months of fighting was captured by the Japanese. He then took part in the infamous Bataan Death March. For two days he carried a seriously ill soldier on his back, ultimately being responsible for saving the man's life. He ended up in Japan, where he spent the war being shuffled from one concentration camp to another. During this time he learned to speak Japanese fluently (he already was fluent in Italian, Spanish, and French). His intellectual ability was underscored by his pursuit of a Ph.D. in civil engineering after he left the Army in the late sixties (he received the degree from the University of Texas in 1971). D'Arezzo found the St. Louis District his most challenging civil works assignment, and he considered the planning for the Meramec Basin one



A view of one of the scenic stretches of the Meramec River.

of the most important accomplishments during his tenure in St. Louis. The new report on the Basin was completed in 1964, and a new Meramec Basin comprehensive plan was approved by Congress in the Flood Control Act of 1966. This new plan called for five reservoirs—Meramec Park, Union, Irondale, Pine Ford, and I-38.²⁰

Meramec Park Lake was to be the first, and pre-construction planning was completed on June 30, 1967. In 1968 acquisition of real estate began. In 1972 the Civil Works Appropriation Act provided \$3,000,000 for initiation of construction. It was at this point that the environmentalists went into action, with the Sierra Club filing the first of several suits aimed at blocking construction of the dam. The Sierra Club's primary objection to the Meramec project was that they considered the environmental impact statement inadequate. They further claimed that the construction of the dam would pose a threat to the Indiana bat, which was an endangered species. However, in 1975 District Judge H. Kenneth Wangelin ruled that construction of Meramec Dam would be permitted. This ruling was upheld unanimously by a 3-judge panel of the 8th U.S. Circuit Court of Appeals in 1976. The public works bill signed into law by President Gerald R. Ford on July 12, 1976, provided \$9.5 million for Meramec Park Lake, including the initial phase of construction of the auxiliary spillway—the first actual construction on the dam itself.²¹

Although the 1976 law also provided funds for work on Union Reservoir and Pine Ford Reservoir, the agitation of the environmentalists seemed certain to slow progress on those projects. Since state approval of the projects would be required, the continued support of state officials would be necessary to assure further Meramec Basin development. Future Corps activities would have to await the settlement of such controversies in the political arena and in the Courts.²²

Despite the construction of these various flood control structures, the battle against flood damage has, in a sense, been a losing one. Flood damages have continued to increase. The primary cause of

this increase, however, has been an accelerating real estate development of urban flood plain land. Construction of flood control projects had created an unrealistic perception among the public of the economic viability of flood plains. In effect, "flood protection has enticed more development which provides more to damage should floods exceed design criteria." To combat this trend, the Flood Control Act of 1960 authorized the Corps of Engineers "to compile and disseminate information on floods and flood damages, including identification of areas subject to inundation... and general criteria for guidance of Federal and non-Federal interests and agencies in the use of flood plain areas; and to provide advice to other Federal agencies and local interests for their use in planning to ameliorate the flood hazard."²³

In 1966, President Lyndon B. Johnson directed Federal agencies to furnish leadership for prevention of the uneconomical development of flood plains. In response to this directive, the Corps created a Flood Plain Management Service which would provide and distribute flood plain information reports as well as providing consultation to state and local agencies for flood damage prevention planning. By the mid-seventies, flood insurance studies for the Department of Housing and Urban Development were also becoming an increasingly important service of the FPMS program.²⁴

Yet the responsibility for using the information still lay with the state and local governments; if they did not implement zoning restrictions based on this data, flood plain development would continue. Nevertheless, this service marked an important step by the Corps toward an increasing reliance on non-structural flood control measures. In the wake of the 1973 flood, the Mississippi River Commission was emphatic in demanding better flood plain management.

Flood control was by this time the single most important activity of the District, but navigation improvement also continued to play a key role in the District's mission. During this period St. Louis was still the busiest port on the Mississippi except for the deep water ports of New Orleans and Baton Rouge.

In the decade from 1959 to 1969 waterborne commerce between Minneapolis and St. Louis increased 92%; between St. Louis and Cairo it increased 86%. By 1972, commerce on the middle Mississippi totalled 67.5 million tons, an increase of 230% over 1959. To permit passage of this increasing volume of river traffic, the St. Louis District continued its efforts to provide a 9-foot channel. On the upper Mississippi this effort entailed the operation and care of the three locks and dams in the District, along with occasional dredging and bank maintenance. On the middle Mississippi this meant maintenance of the Chain of Rocks Canal and Locks 27, continued dredging, construction of new river regulating works (averaging \$1.6 million per year), and maintenance of existing river regulating works (averaging \$1.4 million per year).²⁵

Despite these expenditures, the District was aware as early as 1960 that the existing project was not going to be completely effective under existing specifications. The existing project called for constricting the low-water channel to a width of 1800 feet at low flow, but these specifications simply did not produce the desired results. By 1960, the District had built over 800 timber pile dikes in the Mississippi and for a time it was assumed that the ineffectiveness of the project was due to the inefficiency of the pile dikes. But by 1965 many of the pile dikes had been converted to stone-fill dikes and the 9-foot project still required dredging at various locations. Therefore, in 1966 the District was authorized to build a prototype reach on a typically troublesome part of the river, using a 1200-foot width instead of 1800 feet. This prototype was built between 1967 and 1969; within a short time it proved successful in eliminating the need for dredging—the major goal of river regulating works. As a result of this successful experiment, specifications for the middle Mississippi were changed to a 1500-foot width, with additional contraction at troublesome points. It was anticipated that the expense of additional regulating works would be offset by a reduction in dredging and the greater reliability of the 9-foot channel.²⁶

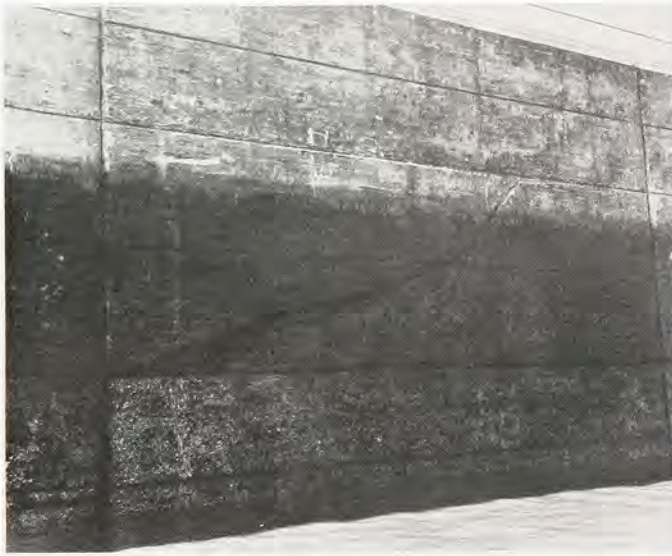


The Corps of Engineers in the 1960s and 1970s was embroiled in controversy, and demonstrations pro and con were not uncommon. In the top picture, a group demonstrates in favor of the Meramec Lake project. Below, a demonstrator makes his views clear at the opening of the Kaskaskia navigation project.



Lock and dam on the Kaskaskia River during construction and completed.

Also during this period, the first navigation improvement project in the St. Louis District on a stream other than the Mississippi or Illinois was built on the Kaskaskia River. This project, approved by the River and Harbor Act of 1962, provided for a lock and dam near the mouth of the river and a nine-foot channel from the mouth to Fayetteville, Illinois. To accomplish this goal, in some places channelization and in some places canalization of the river was undertaken, resulting in a reduction of distance from Fayetteville to the mouth of 30% (from 50.2 to 36.2 miles).



This large crack in one wall of Lock #26 was symptomatic of serious structural weaknesses in the lock.



More important than the reduction in length, however, was the construction of a dam and a lock (84 feet by 600 feet) to provide a nine-foot channel. These improvements, combined with dredging, were designed to allow free movement of barge traffic carrying coal from the surrounding coal country of Illinois to the Mississippi River. Because coal could be moved more cheaply by barge, it was anticipated that the Kaskaskia navigation project would stimulate increased mining activity in the area. Farmers would also benefit from cheaper transportation rates for their grain. In addition, the navigable channel was credited with influencing the 1976 decision of the Federal government to locate a \$237 million experimental coal gasification plant at New Athens, Illinois. The lock and dam were completed in 1974 and the entire project was scheduled for completion in 1980.²⁷

All of this activity was carried on in a relatively uneventful fashion. It was only when the Corps of

Engineers proposed to replace the Alton locks with longer (and thus more efficient) locks that the environmentalists turned their full attention to—and their wrath on—Corps' navigation projects. Locks and Dam No. 26 had been in operation since 1938; from that time commerce passing through the locks had grown from 1.4 million tons in the first year of operation to 55 million tons in 1975. The Alton locks, strategically situated between the upper Mississippi and Illinois Rivers to the north and the Missouri, middle Mississippi, and Ohio Rivers to the south, had become a major bottleneck in the flow of river commerce. The locks reached their practical capacity in 1970. This situation alone would have been sufficient cause for river interests to begin lobbying in Congress for a replacement structure of larger dimensions. However, their case was strengthened even further by the weakening condition of the structure.²⁸

The flaws were numerous—the walls of the locks had moved as much as 10 inches, below the dam a scour hole had occurred which was 50 to 70 feet wide



Tows waiting to use Alton Locks (#26).

and deeper than the piling support for the dam, and the auxiliary lock developed voids in the riverward wall which required a protective rock fill and the closing of two gates in the dam. The problem stemmed from the relatively primitive state of engineering when No. 26 was designed. Although the project was constructed according to the best engineering theory and knowledge available at the time, the erection of the structure on vertical pilings not founded on rock meant that the heavy usage of No. 26 would result in movement in the pilings, and eventual damage to the structure. Once the problem was diagnosed, ameliorative measures were taken, but they could only slow the degeneration of the structure, not reverse it.²⁹

Two alternatives were available—to repair the structure, which would involve closing it to river traffic for at least a year, or to build new locks two miles downstream. The cost of the two projects would be roughly the same. The rivermen supported the Corps of Engineers' proposal for a new dam and two 1200-foot locks. This project would not necessitate

closing the river, and it would enable the standard 15-barge tows to pass through the locks in one 30-minute operation. This faster transit through the locks would eliminate the delays at Alton which averaged 9 hours with the existing facility in 1975. Two other groups also shared with the rivermen a vested interest in the new facility—farmers and electric utilities. For farmers, the delays at Alton meant higher barge rates and thus lower profits. And the possibility of a one-year moratorium on river traffic promised economic disaster. At least 25% of the grain produced in the upper Midwest passed through the Alton locks; shipping that grain at higher railroad rates would mean less profit for farmers and higher prices for consumers. The electric utilities depended on barge shipments of coal for their power plants. In a November 1974 report the Federal Energy Administrator had labeled replacement of the Alton locks as "critical to our capability to meet 1985 energy requirements." Thus farm and utility groups joined barge interests in lobbying for the new locks.³⁰



In 1968, Engineer employees were inspecting the condition of the Lock #26 walls from inside a culvert in the lock wall when water started pouring into the culvert. A photographer hanging from the entrance at the top of the culvert captured their alarm as the employees realized their peril. They escaped safely.

On the opposing side of the issue was a strange and awkward coalition. Environmentalists joined railroad interests in an attempt to thwart construction of the new locks. Their motivations were quite different: the railroads opposed any action which would increase the efficiency of the barge lines and thus give them a competitive edge against the railroads; the environmentalists feared that the Alton project was a first step toward creating a 12-foot channel on the upper Mississippi. The position of the railroads was ironic: an interest group which in the late 19th century had received the greatest government subsidies in American history (and which was still receiving government subsidies in the 1970s) now opposed the Alton project on the grounds that it was a government subsidy to water commerce. They nevertheless spoke out forcefully against expanding the capacity of the Alton facility and called for imposition of a user's fee on any barges using the locks. The environmentalists, on the other hand, had no major objection to the new locks and dam as an individual project. Their concern arose from the specifications of



Colonel James B. Meanor, Jr.
District Engineer, July 8, 1963-August 3, 1966.

the new locks, which called for an 18-foot sill (the lip at the bottom of the lock chamber). They saw the 18-foot sill as an ominous portent of things to come; they suspected that the Corps was trying to "hoodwink the public" and covertly to lay the groundwork for a 12-foot channel on the upper Mississippi—an eventuality which they viewed as ecologically disastrous. Colonel Thorwald R. Peterson, St. Louis District Engineer, denied the allegations of a nefarious Corps' plot and defended the 18-foot sill as providing faster and safer locking operations for the 9-foot channel. The environmentalists, however, felt that recent Corps' studies of a possible 12-foot channel on the upper Mississippi (even though the eventual Corps' recommendation was negative) contained evidence supporting their suspicions of a Corps of Engineers conspiracy. In particular, they were alarmed by statements and illustrations characterizing the 18-foot sill as suitable for a 12-foot channel.³¹

Replacement of the locks was first recommended by District Engineer Colonel James B. Meanor, Jr., in 1964. On July 14, 1969, the Secretary of the Army,



Colonel Edwin R. Decker
District Engineer, August 9, 1966-February 27, 1970



Colonel Guy E. Jester
District Engineer, July 14, 1971-July 31, 1973.



Colonel Carroll N. LeTellier
District Engineer, February 27, 1970-July 14, 1971.

under authority of the 1909 River and Harbor Act, approved construction of the new locks and dam. Preconstruction planning was initiated during the following year and continued until 1974, when it was halted by a court injunction. In August 1974, the Sierra Club and Izaak Walton League had filed parallel suits with the Western Railroad Association to halt the Alton project on the grounds that the authorization and the environmental impact statement were legally defective. Judge Charles R. Richey of the U.S. District Court in Washington, D.C., issued an injunction in September 1974 halting construction. The Corps was required to submit a satisfactory environmental impact statement before the injunction would be lifted. Meanwhile, in February 1976, the Board of Engineers for Rivers and Harbors recommended construction of the new dam, a 1200-foot lock, and a second lock, the size of which would be determined after a two-year study. As of August 1976 the environmental impact statement was under review and the matter was still in the courts.³²



Colonel Thorwald R. Peterson
District Engineer, July 31, 1973-July 23, 1976.



Colonel Leon E. McKinney
District Engineer, July 23, 1976—.

The period after 1960 was a time of marked change in Corps' activities, policies, and priorities. Although flood control and navigation remained important components of the District's mission, new duties were also added to the District's responsibilities. National policy on water-related issues was articulated in a series of new laws which emphasized the increasing significance of water resources management. In 1965, the Water Resources Planning Act established the Water Resources Council and a number of river basin commissions charged with long-range comprehensive planning for a national water resource program. In 1968, Congress affirmed its commitment to environmental enhancement by passing the Wild and Scenic Rivers Act. But perhaps the most important act of all was the National Environmental Policy Act of 1969 which "established a new philosophy to guide Federal thinking and activities which may effect the nation's natural environment." Furthermore, "it establishes preparation of the environmental impact statement as an integral element of the Corps pre-authorization process on all projects and permit-

granting activities." It represented an effort to legislate environmental awareness.³³

Among the considerations to be addressed by the environmental impact statements were the sociological, cultural, biological, demographic, and economic effects, in addition to the environmental impacts, of a proposed project. Unavoidable adverse effects and alternative actions also had to be presented. The Corps was to consult with local, state, and federal agencies, as well as concerned citizens' groups and individuals, to assure the broadest possible input into the impact statement. The Corps was directed to produce a study for each new or ongoing project. Under the terms of this act, then, planning would be institutionalized and given a new importance in Corps' project development.³⁴

Efforts to curb water and air pollution were contained in the Environmental Quality Improvement Act of 1970 and in the Federal Water Pollution Control Act of 1972. Guidelines contained within these acts would affect standards applied by the Corps in its environmental impact statements, as well as reen-



Recreational craft locking through at Alton.

forcing Corps' perceptions of changing national priorities. The latter act also took away some Corps' functions, including determination of "the need for, value of, and impact of water storage for water quality control in any Corps reservoir" which the Act assigned to the Environmental Protection Agency. Responsibility for issuing permits for discharges into navigable waters (except for dredging and filling activities) was also transferred to the EPA. However, the Corps permit program, authority for which was found in the 1899 River and Harbor Act, was expanded by the 1972 Federal Water Pollution Control Act. Henceforth, the Corps would be responsible for issuing permits not only to allow construction of facilities on navigable waters, but also to control the discharge of dredge and fill material. This permit program allows the District to regulate activities on the waterways for the common good.³⁵

In other areas Corps responsibilities were being expanded, as in the case of the National Dam Safety Act of 1972, which called for an inventory of all dams

over a specified size. The St. Louis District was given responsibility for inspecting the dams in Missouri. From 1970 to 1975, the St. Louis District also served as construction administrator for erection of three major postal service facilities, as well as ten minor facilities. The major facilities were the preferential mail facility in St. Louis (this \$30 million project was half-completed when the District assumed responsibility), the main Carbondale post office (\$2 million), and the bulk mail center in St. Louis County (\$25 million). In July 1976 the Corps assumed an expanded role in granting permits to those planning to modify navigable waters in any way, including landfills and discharge of any potential pollutants by dredging.³⁶

In one area the St. Louis District was in the forefront of evolving Corps' responsibilities. In 1970, Congress directed the Corps of Engineers to engage in urban water resource planning in selected metropolitan areas across the nation. St. Louis was one of the pilot areas chosen. The St. Louis Metro Study was designed to produce a plan for action on water resource management for state and local governments and



Present headquarters of the St. Louis District at 210 North 12th St.

agencies. This approach represented "a new direction for the Corps, which historically has planned only in those areas where it had traditional construction authority." Not only was the concept of the Corps as a planning and service agency a new one, but some of the areas of investigation were also relatively new fields for the Corps. In addition to the established areas of flood control, water quality, recreation, fish and wildlife conservation, and regional water supply, the Metro Study was designed to address issues such as flood plain management, waste-water management, and protection and enhancement of environmental qualities. These relatively new problem areas held great promise for future directions in the Corps. The turmoil of the 1960s and 1970s had challenged the Corps "to realign its civil works' program with the needs of the time." The result was a pledge by the Chief of Engineers that "our mission will be to seek to balance the environmental and developmental needs

of our nation." This new attitude required some time to filter down through the Corps' bureaucracy, and environmentalists have remained skeptical, but the Corps' new departures into planning functions reflected an ongoing evolution away from the concept of construction as the inevitable end result of Corps' activities.³⁷

The Corps has been a conservative organization, slow to change, but it has always adapted ultimately to the prevailing values of society. As one writer put it, "changes in Corps' operations will be slow to be perceived and probably will be similar to course changes in the Queen Elizabeth." True to its history of conservatism, it has moved slowly in the area of environmental enhancement, but it nevertheless moved. In fact, by the 1970s the Corps was moving to the forefront of environmental enhancement, especially in such areas as waste-water management and water quality control.³⁸

Thus the nation's Bicentennial year found the Corps of Engineers both nationally and locally in a state of transition. The St. Louis District, with a long history of service to the region, was seeking to adapt to the changing circumstances and values of society so that it could continue to meet the evolving needs of the St. Louis area. Whether and how society would

utilize the diverse talents of the Corps of Engineers was a decision that would be made in the political arena. In the meantime, the St. Louis District would be prepared to undertake whatever tasks were assigned, buoyed through fluctuating fortunes by the indomitability of the Corps' philosophy as reflected in its motto—*Essayons*, "let us try."



Footnotes Chapter 7

1. St. Louis *Globe-Democrat* (February 29-March 1, 1964), 4M; S. Rep. 84-1092, 1-5; H. Rep. 84-1459, 1-3; *Annual Report of the Chief of Engineers, 1974*, XIV-9; U. S. Army Engineer District, St. Louis, "St. Louis Flood Protection Project," (St. Louis, 1974).
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3. Brig. Gen. W.C. Hall, "High Water at St. Louis," *The Military Engineer* 65 (July-August 1973), 259; U.S. Army Corps of Engineers, *Mississippi, 1973; Floods and Flood Control* (Vicksburg, Miss., 1974).
4. *Mississippi, 1973*; "The Swollen Giant," *Time* 101 (April 16, 1973), 23; "The Second Deluge," *Time* 101 (May 7, 1973), 22; Hall, "High Water," 259; "Ol' Man River Just Keeps Rising," *Newsweek* 81 (May 7, 1973), 37-38. One scientist has charged that navigation works also contributed to higher flood stages. See Charles Belt, "The 1973 Flood and Man's Constriction of the Mississippi River," *Science* 189 (August 29, 1975), 681-84.
5. Hall, "High Water," 259; *Mississippi, 1973*.
6. *Mississippi, 1973*.
7. U.S. Army Engineer District, St. Louis, *Heritage on the Mighty Mississippi*, (St. Louis, n.d.), 55-57.
8. 52 *Statutes at Large*, 1215; 72 *Statutes at Large*, 305; *Annual Report, 1959*, 660-61; *Annual Report, 1960*, 647; *Annual Report, 1963*, 642-43; U.S. Army Engineer District, St. Louis, *Environmental Statement, Carlyle Lake, Illinois*, (St. Louis, 1974), 3-4. A reservoir on the Kaskaskia at Carlyle had been considered as early as 1934, but the plan was judged at that time to be "of dubious value." Capt. Bartley M. Harloe to Division Engineer, U.M.V.D., February 26, 1934, Record Group 77, Federal Records Center, Kansas City.
9. *Annual Report, 1963*, 642; *Annual Report, 1961*, 716; Col. Thorwald R. Peterson, "Statement of Findings, Carlyle Lake, Illinois," February 4, 1974, in *Carlyle Lake*.
10. *Annual Report, 1964*, 604; *Annual Report, 1974*, XIV-6; Alphonse C. Van Besien, "Foundation Conditions and Construction Procedures, Shelbyville Dam," in *Annual Report, 1967*, 143-46; U.S. Army Engineer District, St. Louis, *Environmental Statement, Lake Shelbyville, Illinois* (St. Louis, 1975), 1-3, 4; interview with Thomas Mudd, July 1977.
11. William E. Seibel, "The Beneficent Water of Rend Lake," St. Louis *Globe-Democrat Sunday Magazine*, (February 9, 1975), 12-18; *Heritage on Mighty Mississippi*, 58-59; U.S. Congress, House, *Report on Rend Lake Reservoir, Illinois*, H. Doc. 87-541, 87th Congress, 2nd Session, 1962; *Annual Report, 1963*, 646-47; *Annual Report, 1966*, 637; *Annual Report, 1972*, XIV-9.
12. Seibel, "Beneficent Water," 12-18; *Annual Report, 1974*, XIV-9, 10.
13. *Heritage on Mighty Mississippi*, 64-65.
14. U.S. Congress, House, *Report on Salt River, Missouri*, H. Doc. 87-507, 87th Congress, 2nd Session, 1962; *Annual Report, 1963*, 645-46.
15. John A. Ferejohn, *Pork Barrel Politics: Rivers and Harbors Legislation, 1947-1968* (Stanford, Cal., 1974), 88-89.
16. U.S. Army Engineer District, St. Louis, *Environmental Statement, Clarence Cannon Dam and Reservoir, Missouri* (St. Louis, 1975), 1-9; William E. Seibel, "Cannon Dam—for Economic Boom," St. Louis *Globe-Democrat* (October 2, 1975), 18A.
17. Interview with Elmer Huizenga, July 1977; interview with Tom Hewlett and Tony Giardina, July 1977.
18. Capt. Bartley M. Harloe to Division Engineer, U.M.V.D., March 5, 1934, Record Group 77, Federal Records Center, Kansas City; U.S. Congress, House, *Report on Meramec River, Missouri*, H. Doc. 71-686, 71st Congress, 3rd Session, 1931; Donald S. Blair to Capt. Bartley M. Harloe, December 9, 1935, Record Group 77, Federal Records Center, Kansas City. See also Col. Alfred J. D'Arezzo, "Formation of the Plan for Development of the Meramec River Basin," speech delivered to the Engineers' Club, April 12, 1962.
19. U.S. Army Engineer District, St. Louis, *Environmental Statement, Meramec Park Lake, Meramec River, Missouri* (St. Louis, 1973), ONE-1, 3.
20. Interview with Homer Duff, July 1977; interview with Colonel Alfred D'Arezzo, July 1977. At the end of the interview, D'Arezzo cautioned, "Don't get the idea I was some kind of hero; I was just a soldier who did his duty."
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22. St. Louis *Post-Dispatch* (June 18, 1976), 9A.
23. Raymond Merritt, "The Corps and the District, 1866-1976," (draft in author's possession), 19; John Furman Wall, "The Civil Works of the United States Army Corps of Engineers: Program Modernization," (unpublished Ph.D. dissertation, Cornell University, 1973), 232, 237, 260-69, 546; 74 *Statutes at Large*, 50.
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 30. Sally Bixby Defty, "Bargemen Wince at Lock and Dam 26 Delays," *St. Louis Post-Dispatch* (August 17, 1975), 1F, and (August 18, 1975), 3C; Jerri Stroud, "Lock and Dam 26 Delays Hurt Farm Income," *St. Louis Post-Dispatch* (May 20, 1976), 9D; "To Unblock a Waterway," *Illinois Rural Electric News*, reprinted in *St. Louis Post-Dispatch* (February 19, 1976), 2B; "Railroads, Bargemen Find Fund Allies," *Washington Post* (April 10, 1977), 1A, 6A; interview with Arthur Johnson, July 1977.
 31. David P. Garino and Connie S. Harrison, "Railroads Join Environmental Groups to Fight Plan for New River Locks near Alton, Ill.," *Wall Street Journal* (December 3, 1975), 34; Defty, "Bargemen Wince," 3C; Richard K. Weil, Jr., "Corps Denies Lock Would Hike Traffic," *St. Louis Post-Dispatch* (February 25, 1976), 1C. For background on the continuing rail-water controversy, see Harold Kelso, "Waterways versus Railways," *American Economic Review* 31 (September 1941), 539-44.
 32. James B. Meanor, Jr., to author, August 25, 1976; *Annual Report, 1970*, 844-45; Weil, "Corps Denies Hike," 1C.
 33. 79 *Statutes at Large*, 244; Merritt, "Corps and District," 20; Wall, "Civil Works," 172; 82 *Statutes at Large*, 906; 83 *Statutes at Large*, 852; *Annual Report, 1970*, 6. For further information, see Walter C. Carey, "Comprehensive Water Resources and Conservation Planning," *The Military Engineer* 46 (November-December 1954), 419-23.
 34. *Annual Report, 1970*, 6; 83 *Statutes at Large*, 852.
 35. 84 *Statutes at Large*, 114; 86 *Statutes at Large*, 816; Wall, "Civil Works," 482-83; *Annual Report, 1973*, 81; Merritt, "Corps and District," 20-21; interview with John Kilker and Ron Messerli, July 1977.
 36. *Annual Report, 1973*, 81; Jerry Phelan, et al., *Missouri Dams and Dam Safety Program* (St. Louis, Missouri, 1975); interview with Gary Turner, (Construction Division, St. Louis District), August 1976; *Southern Illinoisan*, (June 6, 1976), 3.
 37. U.S. Army Engineer District, St. Louis, *An Overview: The Metro Study: Water Resources Investigation, St. Louis Metropolitan Area Study, Missouri and Illinois* (St. Louis, 1974); Wall, "Civil Works," 207-8, 482. The Metro Study also reflects a broader change in Corps' philosophy from a rural to an urban orientation. On the need for wastewater management, see Rufus Terral's article on "the effluent society" entitled "To Kill a River," *Bulletin of the Atomic Scientists* 20 (September 1964), 35-37. On new attitudes within the Corps, see Christopher Weathersbee, "The New Corps," *Science News* 95 (February 1, 1969), 122-25. For critical views of the Corps, see Arthur Maass, *Muddy Waters—The Army Engineers and the Nation's Rivers* (Cambridge, Mass., 1951); Arthur E. Morgan, *Dams and Other Disasters* (Boston, 1971); Gene Marine, *America the Raped* (New York, 1969); Martin Heuvelmans, *The River Killers* (Harrisburg, Pa., 1973); and Robert G. Sherrill, "The Pork-Barrel Soldiers," *The Nation* 202 (February 14, 1963), 180-83.
 38. Wall, "Civil Works," 567. See also Lt. Gen. Frederick J. Clarke, "Civil Works and Shifting Trends," *The Military Engineer* 63 (March-April 1971), 93-94.

Appendix A

St. Louis District Engineers

Lt. Col. William F. Raynolds
July 12, 1870-Jan. 1, 1873

Col. James H. Simpson
Jan. 1, 1873-Mar. 30, 1880

Maj. Oswald H. Ernst
Mar. 31, 1880-Nov. 12, 1886

Maj. Alexander M. Miller
Nov. 13, 1886-Mar. 4, 1893

Maj. Charles J. Allen
Mar. 5, 1893-Jan. 10, 1896

Lt. Chester Harding
Jan. 10, 1896-Jan. 13, 1896

Maj. Thomas H. Handbury
Jan. 13, 1896-Mar. 21, 1899

Maj. Edward Burr
Mar. 22, 1899-Nov. 7, 1901

Maj. Thomas L. Casey, Jr.
Nov. 7, 1901-Aug. 9, 1906

Col. Clinton B. Sears
Aug. 9, 1906-Jan. 27, 1908

Capt. Gustave R. Lukesh
Jan. 28, 1908-Sept. 30, 1908

Col. William H. Bixby
Sept. 30, 1908-July 26, 1909 and
Feb. 2, 1910-June 7, 1910 and
Aug. 23, 1917-Sept. 15, 1917

Lt. Clarence H. Knight
July 27, 1909-Feb. 2, 1910 and
June 8, 1910-Aug. 22, 1910

Lt. Col. Charles L. Potter
Aug. 23, 1910-July 31, 1912

Col. Curtis McDonald Townsend
Aug. 1, 1912-June 14, 1915

Maj. Wildurr Willing
June 15, 1915-June 6, 1917 and
Feb. 2, 1919-May 31, 1920

Lt. Col. Clarke S. Smith
June 7, 1917-Aug. 23, 1917

William S. Mitchell
Sept. 15, 1917-Feb. 1, 1919

Maj. Dewitt C. Jones
June 1, 1920-Aug. 23, 1922

Maj. Lunsford E. Oliver
Aug. 24, 1922-May 5, 1924

Maj. John C. Gotwals
May 5, 1924-July 19, 1930

Capt. Sylvester E. Nortner
July 19, 1930-Nov. 4, 1930

Maj. William A. Snow
Nov. 4, 1930-Dec. 1, 1933

Maj. Bartley M. Harloe
Dec. 1, 1933-July 22, 1935

Lt. Col. Paul S. Reinecke
July 22, 1935-July 15, 1940

Col. Roy W. Grower
July 15, 1940-Aug. 4, 1942

Col. Lawrence B. Feagin
Aug. 4, 1942-Aug. 25, 1946

Col. Rudolph E. Smyser, Jr.
Aug. 25, 1946-Dec. 30, 1949

Col. Beverly C. Snow
Dec. 30, 1949-Jan. 29, 1951

Col. Fred E. Ressegieu
July 18, 1951-July 20, 1954

Col. George E. White, Jr.
July 1, 1954-May 31, 1957

Col. Charles B. Schweizer
Sept. 1, 1957-July 21, 1960

Col. Alfred J. D'Arezzo
Aug. 1, 1960-May 1, 1963

Col. James B. Meanor, Jr.
July 8, 1963-Aug. 3, 1966

Col. Edwin R. Decker
Aug. 9, 1966-Feb. 27, 1970

Col. Carroll N. LeTellier
Feb. 27, 1970-July 14, 1971

Col. Guy E. Jester
July 14, 1971-July 31, 1973

Col. Thorwald R. Peterson
July 31, 1973-July 23, 1976

Col. Leon McKinney
July 23, 1976—

Appendix B

Distinguished Civilian Employees



William S. Mitchell
1878-1931



Charles D. Lamb
1882-1923



Gaston G. Crane
1883-1930



Edward J. Harrington
1920-1949



Marshall Gray
1923-1965



John C. Debolt
1924-1928



William M. Penniman
1891-1934



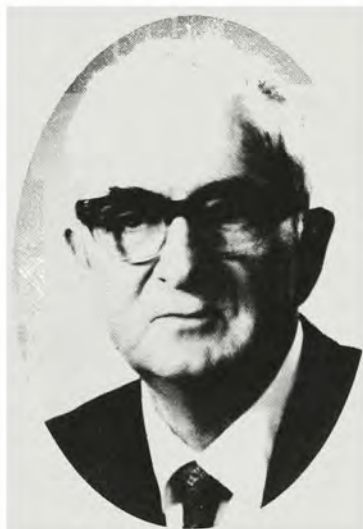
James E. Kennedy
1892-1938



Edward C. Constance
1904-1943



Lowell C. Oheim
1927-1970



Walter F. Lawlor
1931-1969

Appendix C

ESTIMATES OF COMMERCIAL TONNAGE ON MISSISSIPPI RIVER

Year	Tonnage	Year	Tonnage
1824	90,000	1862	950,000
1825	80,000	1863	1,100,000
1826	90,000	1864	1,650,000
1827	120,000	1865	2,251,523
1828	118,000	1866	2,246,492
1829	108,000	1867	1,988,797
1830	120,000	1868	1,932,976
1831	135,000	1869	2,243,499
1832	145,000	1870	2,136,300
1833	170,000	1871	1,653,899
1834	174,000	1872	1,669,201
1835	246,000	1873	1,654,899
1836	439,000	1874	1,440,090
1837	450,000	1875	1,302,620
1838	440,000	1876	1,288,970
1839	426,000	1877	1,242,155
1840	488,000	1878	1,329,370
1841	500,000	1879	1,365,415
1842	450,000	1880	2,129,700
1843	550,000	1881	2,092,455
1844	716,000	1882	1,843,475
1845	735,000	1883	1,537,850
1846	816,000	1884	1,275,590
1847	1,169,000	1885	1,267,100
1848	1,376,000	1886	1,332,885
1849	1,268,000	1887	1,503,105
1850	1,280,000	1888	1,276,182
1851	1,270,000	1889	1,413,594
1852	1,300,000	1890	1,299,679
1853	1,310,000	1891	1,125,423
1854	1,370,000	1892	1,208,205
1855	1,440,000	1893	1,057,599
1856	1,500,000	1894	1,003,710
1857	1,470,000	1895	838,900
1858	1,400,000	1896	1,319,688
1859	1,465,000	1897	1,115,850
1860	1,420,000	1898	959,953
1861	800,000	1899	700,531

BETWEEN OHIO AND MISSOURI RIVERS (1824 – 1975)

Year	Tonnage	Year	Tonnage
1900	810,230	1938	3,056,945
1901	703,054	1939	2,536,513
1902	658,361	1940	3,094,612
1903	596,484	1941	3,488,269
1904	421,607	1942	3,147,476
1905	440,154	1943	3,156,530
1906	470,093	1944	4,775,489
1907	435,542	1945	4,449,200
1908	374,093	1946	4,190,570
1909	352,055	1947	5,746,160
1910	191,965	1948	9,464,196
1911	369,295	1949	9,427,505
1912	265,720	1950	11,577,850
1913	258,709	1951	12,040,875
1914	204,118	1952	13,285,980
1915	258,501	1953	15,942,576
1916	240,643	1954	17,663,048
1917	293,248	1955	20,173,035
1918	264,149	1956	22,895,688
1919	288,286	1957	23,674,777
1920	363,082	1958	25,701,271
1921	481,151	1959	29,327,697
1922	548,114	1960	30,021,316
1923	723,068	1961	31,174,541
1924	738,728	1962	35,190,454
1925	1,003,569	1963	35,726,911
1926	1,005,979	1964	38,516,345
1927	1,110,402	1965	41,532,117
1928	1,430,183	1966	46,398,038
1929	891,756	1967	49,460,884
1930	926,957	1968	50,118,643
1931	1,303,034	1969	54,616,113
1932	1,577,390	1970	58,338,622
1933	1,998,963	1971	58,518,767
1934	1,858,011	1972	67,545,404
1935	1,729,093	1973	63,385,876
1936	1,944,536	1974	69,995,050
1937	2,251,497	1975	71,623,162

Selected Bibliography

Manuscript and Governmental Sources

Unpublished manuscript materials relating to the St. Louis District are contained in Record Group 77, the records of the Office of the Chief of Engineers. These files are divided among several depositories: the National Archives in Washington, D.C.; the Federal Records Center at Suitland, Maryland; and the Federal Records Center at Kansas City, Missouri. The James B. Eads collection of the Missouri Historical Society provided useful background information, as did the letters of Robert E. Lee to Henry Kayser, which are conveniently reprinted in *Glimpses of the Past*, 3 (January-February, 1936), 1-43. Official government publications were also important sources of information—especially Congressional documents, reports, and hearings, and the Annual Reports of the Chief of Engineers. Finally, the publications of the Office of the Chief of Engineers and of the St. Louis District—especially environmental impact statements and informational accounts—provided important material for this study. All manuscript sources and governmental publications are cited individually in the footnotes.

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